FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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Flight

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list :—

1926

Nov. 4 .... Mr. G. F. Mucklow. "Hydrogen as an Auxiliary Fuel for a Solid Injection Engine." Joint Meeting R.Ae.S. and Inst.A.E.

Nov. 11 .... Schneider Cup Race at Norfolk, Virginia, U.S.A.

Nov. 16 .... Mr. A. G. von Baumhauer, Sub-Director of the Government Aeronautical Laboratories, Amsterdam. "Some Notes on the Possibilities of Progress in Aviation," before Inst.Ae.E.

Nov. 18 .... Mr. R. S. Capon. "Methods of Performance Testing and Analysis," before R.Ae.S.

Nov. 21 .... Lecture, "Meteorology in the Service of Msn," by Dr. G. C. Simpson, C.B., at the Guildhouse, Eccleston Square, S.W.1.

Nov. 30 .... Mr. F. S. Barton, M.A., F.Inst.P. "Air Photography Apparatus," before Inst.Ae.E.

Dec. 2 .... Mr. P. B. Bradshaw. "Alloy Steels for Aero Work," before R.Ae.S.

Dec. 3-19 .... Paris Aero Show

EDITORIAL COMMENT.

NOTHING is more refreshing, when one has been submerged, as it were, in a set of problems along accepted lines, than suddenly to have sprung upon one an entirely new view-point opening up fresh fields for thought and contemplation. The paper read by Mr. G. H. Dowty before the Institution of Aeronautical Engineers on October 26 was in the nature of such a surprise, at any rate that part of his paper which dealt with what he termed "Arrester gears." When one comes to think of it, it is rather amazing, as Dr. Thurston pointed out during the discussion, that although we have made great strides as regards aeroplanes in the air, when it comes to alighting we are very much where we were in the earliest days of flying. One might even compare an aeroplane with a motor-car without brakes. Such a thing would appear quite ridiculous; yet that is roughly the position as regards the aeroplane attempting to land, and this in spite of the fact that the aeroplane, with its relatively greater speed, would seem to be even more in need of braking devices than any other form of vehicle. Yet we have continued to rest content with relying upon the deceleration due to the air forces on the aeroplane, and to the—fairly small—frictional resistance due to undercarriage and tail skid. Wheel brakes have been tried, it is true, but not with any great success, mainly, probably, because if the retarding effect of the brakes is to be worth while, there is a good deal of risk of locking the wheels and standing the machine on its nose. Mr. Dowty's suggestion of an arrester gear, capable of pulling a machine up in something like 300 ft., no matter, within reason, what its speed, is therefore interesting, to say the least of it.

Breaking New Ground

We are aware, of course, that something of the sort has been tried in America with a certain amount of success, but we gather that during the first attempts, which were admittedly made with somewhat crude apparatus, the brake mechanism seized, the aeroplane

stopped suddenly, and the pilot went on! In the American experiment a light pole was suspended from the aeroplane at an angle, and carried at its free end a hook or grapnel arrangement, which was fastened to the pole in such a manner that quite a small pull on the hook pulled it off the pole, which then swung up against the bottom of the fuselage, while the hook, which was attached to a cable, engaged with cross ropes on the ground, and stretched a cable secured to the machine itself. In principle, the idea appears identical with that suggested by Mr. Dowty, although doubtless the details were somewhat different.

The crux of the whole matter would appear to be, as stated by Mr. Dowty, to devise some form of brake drum which will have a very low resistance at first, the resistance gradually increasing to a maximum and then remaining permanent to the end of the stroke. At the same time such a brake mechanism must be able automatically to adapt itself to various speeds of alighting. One way of attaining this end was illustrated at Mr. Dowty's lecture, but it cannot be said that this represented other than a very roundabout way of attaining the desired end. Doubtless this was due to the fact that Mr. Dowty is patenting, in connection with the Gloucestershire Aircraft Company, a more recent form of brake drum, which may be assumed to be a good deal simpler. At any rate, the difficulties of designing some form of brake drum with these characteristics should certainly not be insuperable, and if the scheme is found worth while developing there is no reason to doubt that several forms of brake drum will be produced.

In the absence of actual experiments it is difficult to decide definitely what are the uses to which such an arresting gear might be put. Certain fundamental considerations do, however, arise. The obvious use, and the one to which Mr. Dowty particularly referred, is, of course, in connection with deck landing. As was pointed out, the difficulties of deck landing under present conditions result in the use, for this purpose, of machines with a relatively low stalling speed, and consequently with a somewhat impaired top speed thus needlessly (needlessly, that is, if the arrester gear can be evolved successfully) handicapping the machines used for operating from shipboard. If it should prove feasible to arrest machines coming in at 80 knots or more, then evidently aircraft with a much higher all-round performance could be used. Fundamentally, there does not appear to be any reason to believe that the problems cannot be solved, and it is, to our way of thinking, in connection with deck landing that the arrester gear is likely to have its greatest utility. The scheme certainly seems promising, and is, we think, deserving of very serious consideration by the Government departments most directly concerned.

The author of the paper also suggested that the device might be of use in connection with Army aeroplanes in that it would enable the machines to alight in very confined spaces, which might be of great advantage during a war over country where large aerodromes were not easily established. To us it seems rather doubtful whether this would really be so. It should be remembered that if the presence of an arrester gear at the base were made the excuse for putting up the landing speed of machines, then, in case of a forced landing, pilots used to landing "engine on" would be very likely to crash if compelled to alight without their engine in confined areas.

Mr. Dowty's suggestion of the uses of the arrester gear for commercial machines seems to us to suffer from very much the same disadvantages, plus the fact that the size of aerodromes for machines of commercial type is determined not so much by the size of field into which a machine can be brought safely, as the size of field out of which a machine can be flown. In other words, for machines of this type it is the take-off rather than the landing which determines the size of field.

Taking it all round, it seems to us that it is in connection with deck landing that the arrester gear is most likely to be of service, and there we believe it to have very great possibilities indeed, and worthy of the most serious consideration. At any rate, Mr. Dowty has given us something to think about.

Duke of York's Message to Royal Aeronautical Society

THE Royal Aeronautical Society held a reception to the Dominion Prime Ministers and delegates to the Imperial Conference on October 25, at which some 400 guests were received by the President of the Society, Air Vice-Marshal Sir Sefton Brancker. The following letter from the Duke of York, addressed to Sir Sefton Brancker, was read:—

"I very much regret that I will be unable to be present at the Royal Aeronautical Society's reception on October 25.

"I am proud to feel that the Prince of Wales and I share between us the honour of being patrons of the oldest aeronautical body in the world, and it would have given me the greatest satisfaction to be able to attend the reception.

"The work of the Society is growing constantly in magnitude and importance. Its position can be maintained and improved only if all those connected either directly or indirectly with aeronautics give their fullest support. The munificent gift by the Guggenheim Trust Fund of the U.S.A. will in a measure enable the scope of the Society's activities to be widened, and I hope that those public-spirited persons or bodies who have in the past done so much to help forward our other great societies will give assistance so that a substantial Endowment Fund may be established.—Yours sincerely,

"ALBERT."

Sir Alan Cobham Still Busy

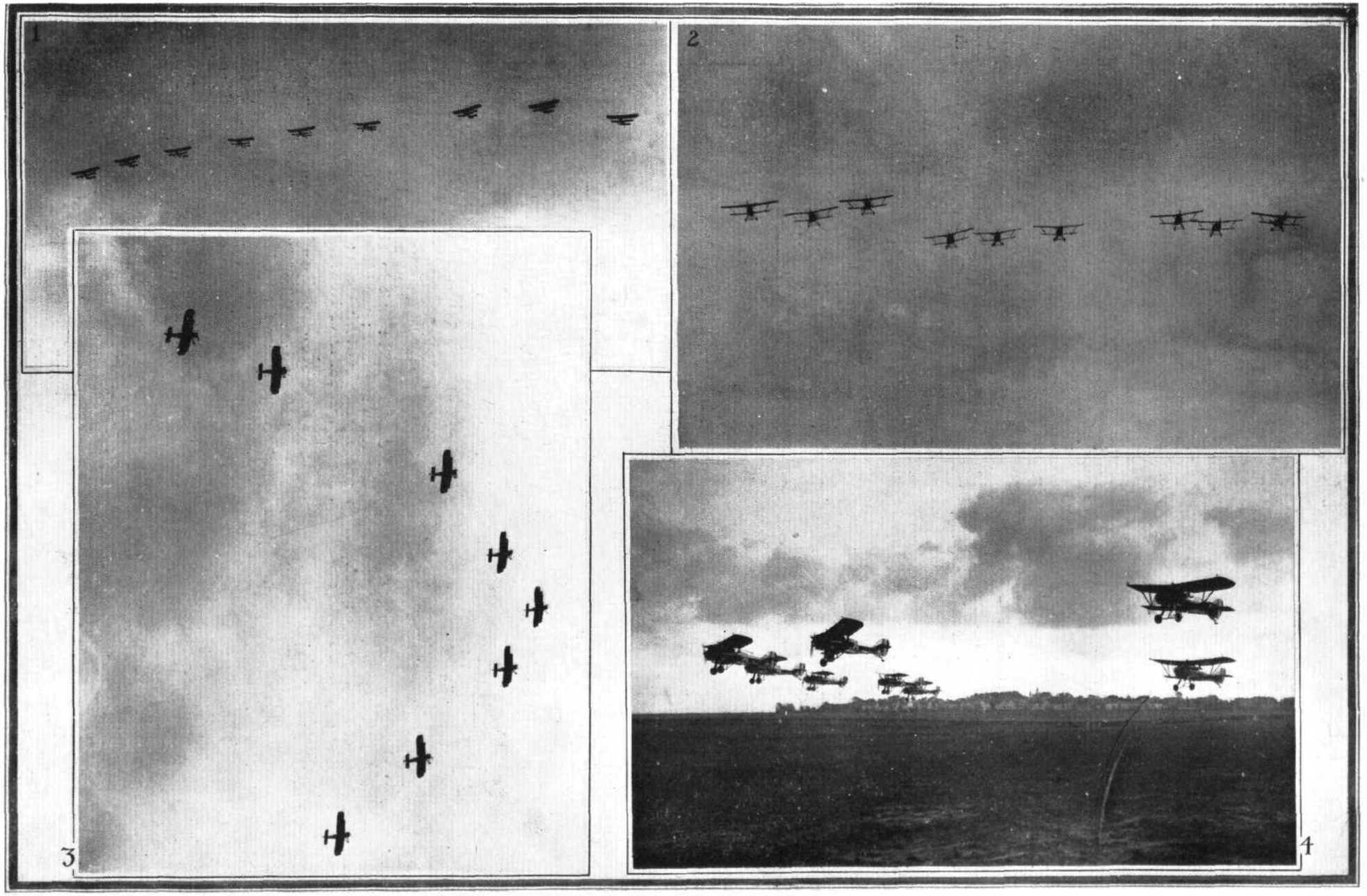
ON October 22 Sir Alan Cobham was entertained at luncheon at the Café Royal by the Foreign Press Association, Air Vice-Marshal Sir Sefton Brancker, Sir Joseph Cook (Agent-General for Australia) and Lady Cobham being present.

Sir Alan, with Lady Cobham as passenger, flew in a D.H. "Moth" from London to the Seven Sisters Cliffs, Eastbourne, where he made an appeal on behalf of the Seven Sisters Cliffs Preservation Fund—this beauty spot being threatened by a building scheme. After auctioning various articles, Sir Alan then sold handshakes for 5*s*. each. Altogether, it is estimated that Sir Alan's visit resulted in more than £500 being subscribed.

On October 25 Sir Alan was present at a reception given by the Royal Aeronautical Society to the Dominion Prime Ministers, when it was announced that he had been made an Honorary Fellow of the Society, and that Sergt. Ward and Mr. Capel had been made life associates.

The Late Mr. E. T. Willows

IT has been decided by a number of fellow aeronauts and friends of Mr. E. T Willows, the airship pioneer, who was recently fatally injured at Bedford, to make an attempt to raise a fund to assist Mrs. Willows and her three children, who are left without any means whatever. C. G. Spencer and Sons, Ltd., have promised a contribution of 100 guineas. Donations may be sent direct to Midland Bank, Ltd., 431, Oxford Street, London, and crossed "Willows' Fund Committee," or to the Hon. Secretary, Mrs. Sydney R. Hibbard, 14, Eton Villas, Hampstead, N.W.3.



["FLIGHT" *Photographs*

AIR MANŒUVRES BY RADIO-TELEPHONY: One of the most impressive sights at the Croydon Demonstration was the squadron drill carried out by pilots of No. 41 (Fighter) Squadron, Northolt, on Armstrong-Whitworth "Siskins" with Armstrong-Siddeley "Jaguar" engines. Our photographs show the machines in (1) line abreast, (2) flight mass-line abreast, and (3) squadron formation; (4) shows the machines taking off in formation. The manœuvres were rendered more difficult by a strong gusty wind.

CROYDON AIR DEMONSTRATION

Impressive Spectacle Staged before Dominion Representatives

ALTHOUGH many of our latest types of aircraft were absent from the demonstration given at Croydon on Saturday last for the benefit of the Dominion representatives gathered in London for the Imperial Conference, there can be not the slightest doubt that the display gave a picture of very considerable progress made in the science and art of aviation since the last demonstration of this kind. This progress was traceable, as regards flying material, more on the civilian than on the Service side, but this was due to the fact that whereas all but one of our commercial types of aeroplanes were present at the demonstration, a number of new types of Service aircraft were absent for one reason or another. On the other hand the flying displays given demonstrated the very great strides that have been made of recent years in the handling of aircraft by Service pilots and the display given by piolts of 41 Squadron of air manœuvres by radio-telephony cannot have failed to impress our Dominion visitors, although the strong gusty wind which was blowing at the time rendered the work of the pilots a good deal more difficult than it would have been in calmer weather.

The Dominion Ministers and High Commissioners and other visitors were received by the Secretary of State for Air, which might be required. The visitors grouped themselves into smaller parties and commenced making the round of the machines. Mr. Bruce, the Australian Prime Minister, in particular, making a most thorough inspection of all the different types. One gathered the impression that Mr. Bruce is very keenly interested in and alive to the possibilities of aviation in Australia, an indication of the determination of the Commonwealth of Australia to make every possible use of the advantages which aircraft have to offer.

A complete list of the types of aircraft present at the demonstration was given in last week's issue of FLIGHT, and so there is no need to repeat the list this week. Among some of the newer types of Service aircraft that were inspected, the following attracted considerable attention, and came in for very favourable comment by discerning visitors : in the single-seater fighter class the Hawker "Woodcock" and the Gloster "Gamecock" and "Grebe" and the Armstrong-Whitworth "Siskin." It seemed rather a pity that our four latest high-speed single-seater fighters were unable to be present, these being, of course, the Avro "Avenger," the Hawker "Hornbill," the Fairy "Firefly" and the Gloster "Gorcock." Among the single-engined day-bombers the

["FLIGHT" *Photograph*

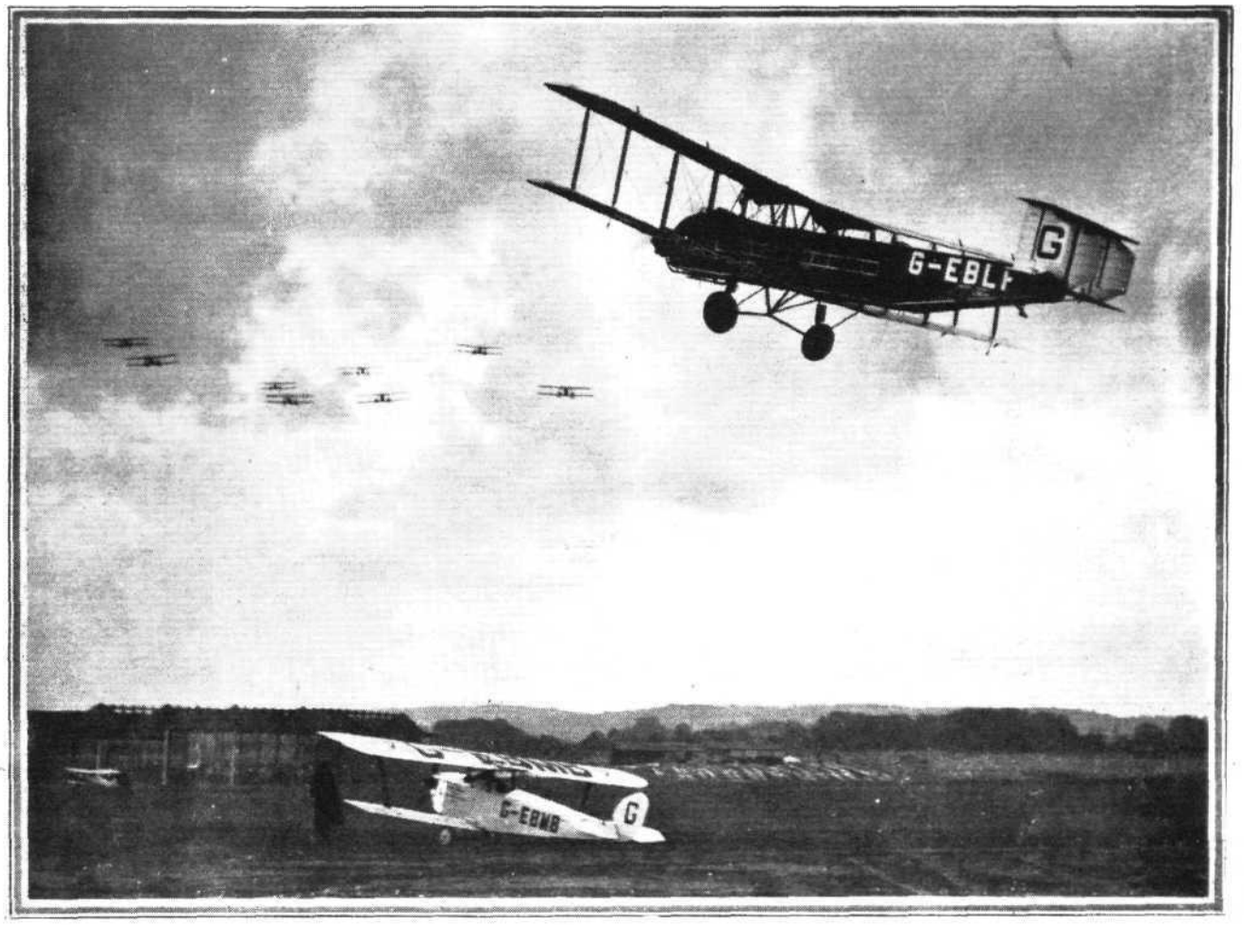
BRITISH MINISTERS AND THEIR DOMINION GUESTS AT CROYDON : Left to right : Sir Philip Sassoon, Under-Secretary of State for Air ; Mr. Mackenzie King, Canadian Premier ; the Maharajah of Burdwan ; Sir Samuel Hoare, Secretary of State for Air ; Mr. Bruce, Prime Minister of Australia ; General Herzog, Prime Minister of South Africa ; and Mr. Monroe, Premier of Newfoundland.

Sir Samuel Hoare, and by Air Chief Marshal Sir Hugh Trenchard, who were accompanied by Sir Philip Sassoon, Under-Secretary of State for Air, the Right Hon. Winston Churchill, the Right Hon. L. S. Amery and Mrs. Amery, Air Marshal Sir John Salmond, Air Vice-Marshal Sir Geoffrey Salmond and Lady Salmond, and Air Vice-Marshal Sir Sefton Brancker, Director of Civil Aviation. The day was by no means an ideal one for such a demonstration, a cold north-easterly wind blowing right across the aerodrome, the direction being such that it was impossible to find shelter from it anywhere. It is estimated that some 200 visitors attended the demonstration, as the guests of the Government Hospitality Fund. Upon arrival at the aerodrome it was found that a large number of different types of aircraft, ranging in size and power from the small two-seater light 'plane to the largest three-engined commercial aircraft, were lined up in the aircraft "park," and the first item of the day's programme was an inspection of all these. In the case of the Service types the pilots and crews of the machines were standing by in order to give to the visitors any explanation

Hawker "Horsley" with Rolls-Royce "Condor" and the Fairey "Fox" with Fairey "Felix" were particularly admired, the former for its impressive size and generally businesslike appearance, and the latter for its clean lines and absence of excrescences. A Fairey "Fawn" was decorated with an air screw projecting on a bracket from the side of the fuselage and placed horizontally, and might have given the uninitiated the impression that this machine was gradually growing into an "Autogiro" The crew in charge of the machine explained, however, that the "Fawn" was used for towing targets for anti-aircraft gunnery practice, and that the function of the windmill was to wind in the 6,000 feet of cable or so, which connects the target to the machine. When not in use the windmill was turned into a horizontal position.

The night-bombing class of aeroplanes included the Vickers "Virginia" and "Vimy" and the Handley Page "Hyderabad."

The troop-carrier class of aeroplane was represented by a Vickers "Victoria" fitted with two Napier "Lions." This machine carries, in addition to its crew, 24 fully-equipped



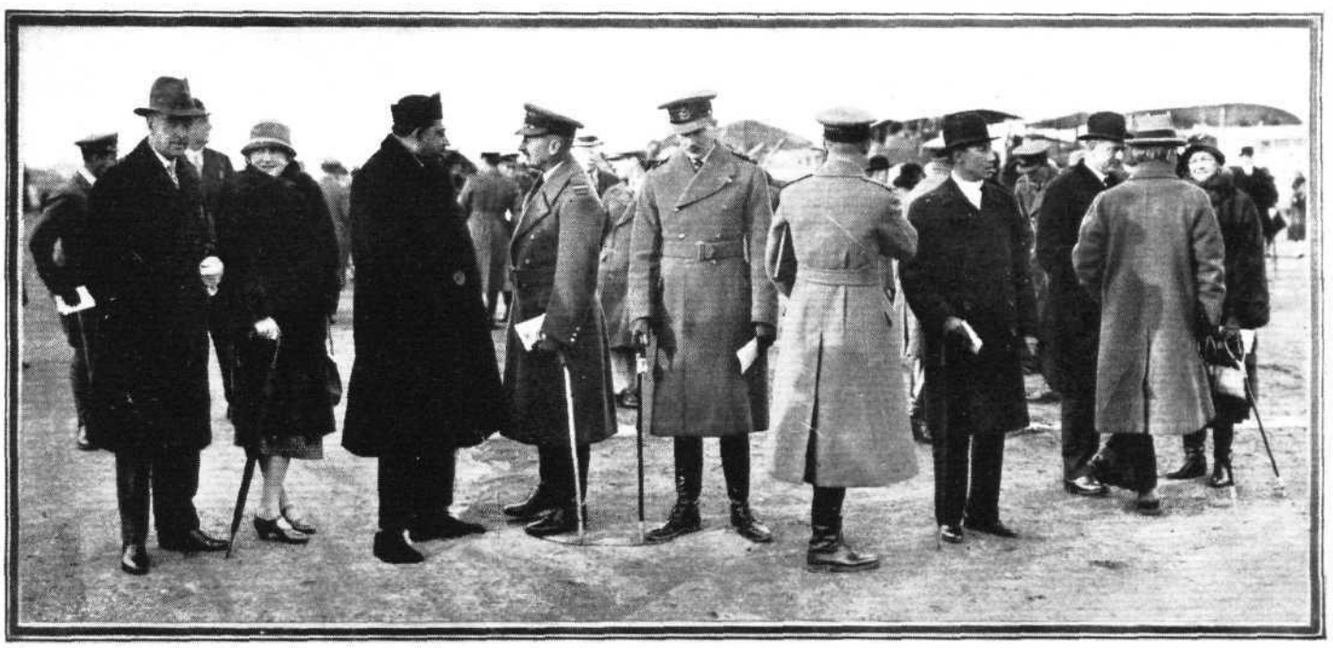
["FLIGHT" *Photograph*

IMPUDENCE AND DIGNITY AT THE CROYDON DEMONSTRATION : This photograph shows the Hawker "Cygnet" light 'plane taking off, with the Armstrong-Whitworth "Argosy" three-engined commercial aeroplane flying above it and a squadron of Vickers "Virginia" night bombers in the distance.

infantry men, or an equivalent weight of supplies, ammunition, etc.

The Army co-operation type was represented by a Bristol Fighter, a type which has given many years of excellent service, but which is now we believe, to be relieved by a later type, the Armstrong-Whitworth "Atlas."

A great deal of interest was aroused by the aircraft designed for work with the Fleet Air Arm, and intended for taking off from and alighting on the deck of an aircraft carrier Among these the Blackburn "Blackburn" and the Avro "Bison," both with Napier "Lion" engines, represented a type known as Fleet gunnery spotters, whose function is to report the



["FLIGHT" *Photograph*

AT THE CROYDON DEMONSTRATION : In this group of distinguished visitors may be recognised, from left to right : Mr. T. O. M. Sopwith, C.B.E., and the Hon. Mrs. Sopwith, the Maharajah of Burdwan, Air Vice-Marshal Sir Geoffrey Salmond, Air Marshal Sir John Salmond, Sir Philip Sassoon, Air Chief Marshal Sir Hugh Trenchard (in background), Sir Harry Brittain, and Lady Maud Hoare.

["FLIGHT" *Photograph*

RETURNING FROM CROYDON : The Handley Page "Hamlet" arriving at Cricklewood after its visit to the Croydon demonstration.

accuracy or otherwise of the naval guns after the fleets have come into action. The torpedo-dropping type was represented by a Blackburn "Dart" and the reconnaissance type by the well-tried and trusty Fairey IIID, while a Fairey "Flycatcher" represented the machines intended for fighting enemy aircraft.

Among civilian types of aircraft a number of the latest types were on view, such as the three-engined Armstrong-Whitworth "Argosy," the three-engined Handley Page "Hampstead," and several types of twin-engined Handley Page commercial aeroplanes. As the latest machine to be completed, a good deal of interest naturally attached to the Handley Page "Hamlet," a small three-engined monoplane fitted with Bristol "Lucifer" engines and designed to carry, in addition to the pilot, four passengers in a comfortable cabin. This is the lowest-powered three-engined commercial machine hitherto built in this country, and is intended for use over routes where the volume of traffic is not yet such as to justify the operation of more powerful three-engined machines, but where the reliability offered by the three-engined type, capable of flying on any two of its engines, is desired. As the machine has but recently been fully described and illustrated in FLIGHT, we need only say here that it is fitted with the Handley Page patent slotted wings. The De Havilland 50J used by Sir Alan Cobham, not only on his recent flight to Australia and back, but in many other famous flights, and which has by now flown a total distance of somewhere in the neighbourhood of 125,000 miles, was very naturally the object of a close examination by the visitors. The machine was shown in the form in which it was used over the greater portion of the flight to Australia,

["FLIGHT" *Photograph*

Just the thing for Australia? : Mr. Bruce, Prime Minister of Australia, and Mrs. Bruce interested in the Handley Page "Hamlet" three-engined monoplane.

i.e., fitted with the Short Duralumin floats, which appeared to be in amazingly good condition considering the gruelling test through which they have been during the Australian flight. Among so many multi-engined types the De Havilland 54 "Highclere" stood out as the only representative of the single-engined type. This machine has a very excellent performance, and is an efficient commercial aeroplane, but owing to the policy of Imperial Airways of gradually switching over to three-engined aircraft, the machine is at present mainly being used for experimental purposes, and on Saturday it was of particular interest because of the fact that it was fitted with a gyro rudder control and pendulum aileron control. The former consists of a gyroscope, driven by compressed air, which is connected to a servo motor coupled to the rudder control. Once the gyroscope is running at full speed the pilot can set this control to any course desired, and the machine will then remain on this course almost indefinitely. For flying in fog or low clouds this device should have many advantages, and doubtless will come into general use later, when it becomes the rule to navigate above the clouds or fog over long distances. The pendulum aileron control works in conjunction with the gyro rudder control, but makes use of a pendulum in place of the gyroscope, the pendulum operating the servo motor which is coupled to the aileron control. It was greatly to be regretted that the new De Havilland 66 could not be present. The "Hercules," as this machine is called, is a three-engined commercial aeroplane fitted with three Bristol "Jupiter" engines, and is to be put in service on the Cairo-Karachi route when that comes into operation. The De Havilland Company are very busy getting the type ready for the flights to the East, which are scheduled to take place shortly, and so the machine could not be spared for the Croydon demonstration.

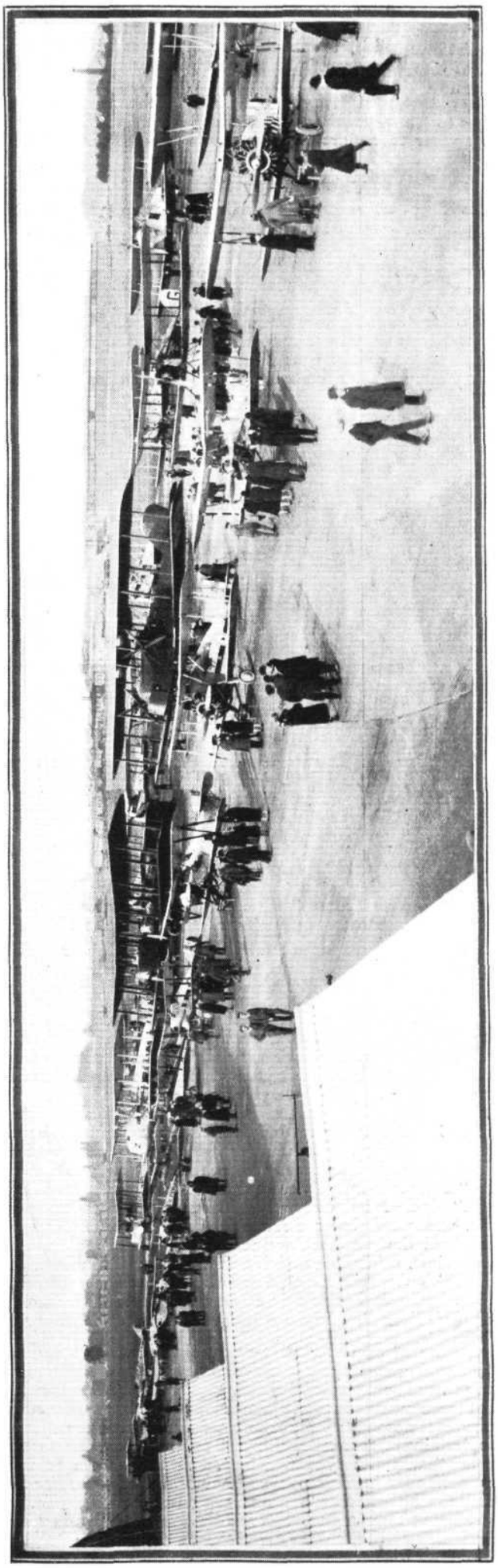
Finally, the series of types inspected was completed by a few two-seater light 'planes, among which was the Hawker "Cygnet" which won the recent *Daily Mail* light 'plane competition. The Avro "Avian" was also on view, and it was noted that a different rudder and small triangular fin had been substituted for the large balanced rudder fitted to the machine at Lympne. The Bristol "Brownie" and the Blackburn "Bluebird" were other Lympne types inspected, while a De Havilland "Moth" represented the type used as a standard club machine by the light aeroplane clubs, and the Westland "Widgeon" monoplane represented a high-speed type which did not, however, take part in the Lympne competition. The Short "Mussel" was exhibited with its float undercarriage, for which it was originally designed, although it can also be, and indeed has been, fitted with a wheel undercarriage for use as a land aeroplane.

Aerobatics

The first item on the programme as regards actual flying was a demonstration of aerobatics by two pilots of No. 56 (Fighter) Squadron, R.A.F., mounted on Gloster "Grebes." The official programme erroneously gave the type of machine used as an Armstrong-Whitworth "Siskin," a mistake which, it is to be feared, led to some slight confusion on the part of those visitors not intimately acquainted with British Service types. The two pilots gave an excellent demonstration of stunts such as spins, loops, rolls, etc., the roll particularly appearing to be their favourite trick.

This event was followed by a demonstration of air manœuvres by radio-telephony, carried out by nine pilots of No. 41 (Fighter) Squadron, R.A.F., flying Armstrong-Whitworth "Siskins" (not as stated in the official programme, Gloster "Grebes"). This squadron consisted of three flights of three aeroplanes each, and the orders for the various evolutions required during the demonstration were transmitted from the ground station (whose call sign was "Martin") to the Squadron Commander (call sign "Condor R"). The orders were acknowledged by the Squadron Commander, who in due course re-transmitted them to the flights of his squadron. The call sign of the squadron was "Condor."

The wireless telephony orders given by the ground station and by the Squadron Commander were broadcast through loud speakers on the aerodrome, so that it was possible to follow closely what was taking place. The squadron went through a series of evolutions changing from one formation to another, and generally carrying out such manœuvres as have in the past mainly been associated with the famous 25 (Fighter) Squadron. Judged solely on Saturday's demonstration, 41 Squadron was not, perhaps, quite up to the form of its famous pattern, but it should be kept in mind that the day was a very bad one for this kind of demonstration, the wind being very strong and extremely gusty, as was easily discernible even from the ground by watching the machines



["FLIGHT" *Photograph*

AT THE CROYDON DEMONSTRATION: Some of the machines lined up in the Aircraft park.

being buffeted about. On this occasion the Squadron Commander did not fly in the formation, but cruised around some distance away, thus obtaining always a view of the whole of the squadron. This should materially facilitate keeping an eye on the various units, and it is somewhat of a mystery how the Squadron Leader of the famous 25 Squadron manages to see what each of his pilots is doing, since to do so would appear to require telescopic and universally pivoted eyes.

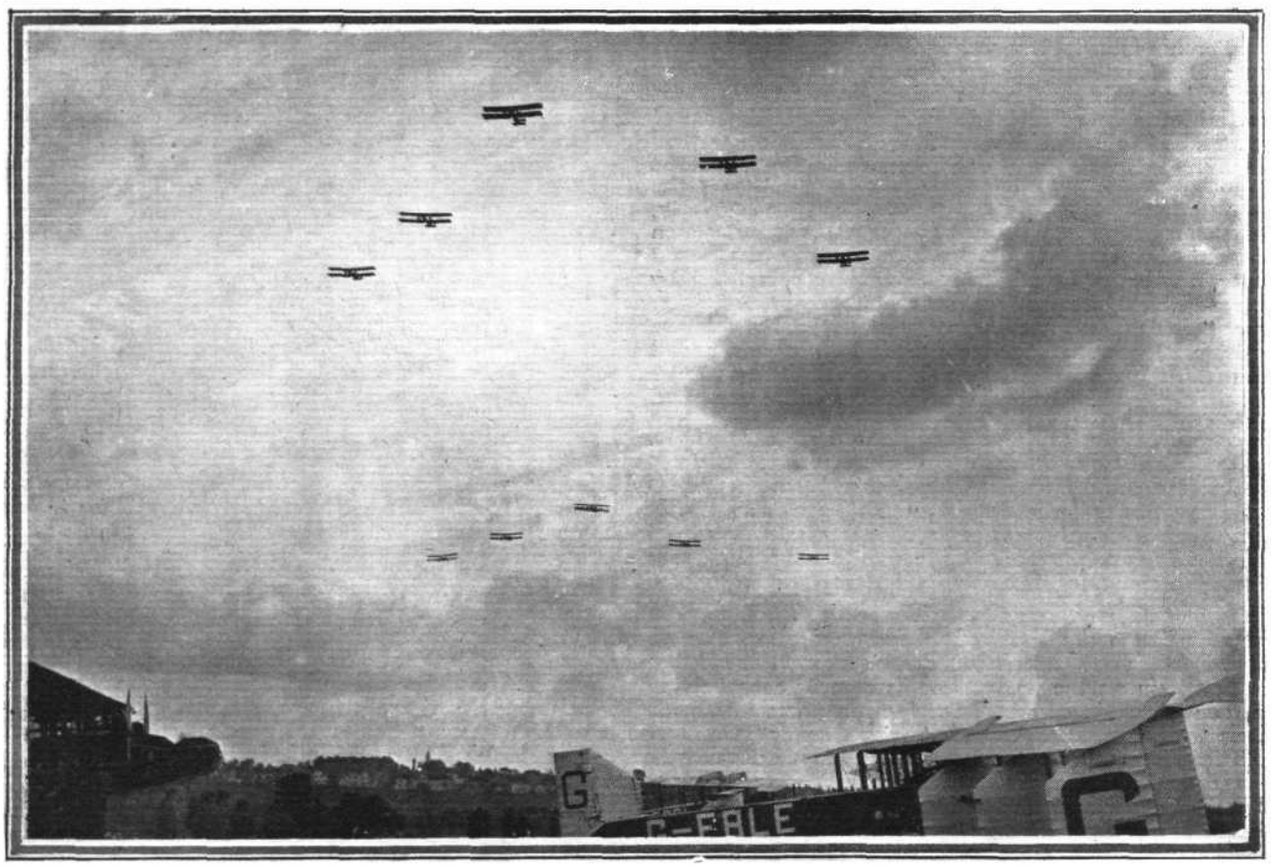
The "Heavy Stuff"

Immediately the "Siskin" squadron had landed, two Air Force squadrons of Vickers "Virginias" from Nos. 7 and 9 Bombing Squadrons, flew over the aerodrome in formation. What this squadron of ten huge bombers lacked in agility it made up for by sheer weight, and it was estimated that the ten machines as they flew across the aerodrome represented something like 80 tons of matter (some of it very unpleasant matter for somebody in time of war) in the air.

The next item on the programme was a display by Mrs. Eliott-Lynn on a De Havilland "Moth." Mrs. Eliott-Lynn, whose "swan song" this was believed to be, wheeled the "Moth" out of its hangar, unfolded its wings and took the air, and after giving a series of evolutions she alighted, again folded the wings of her machine, and garaged it. In the meantime, Flight-Lieut. Bulman went up on the Hawker "Cygnet" on which he won the *Daily Mail* competition recently, while Flying Officer Ragg ascended in the R.A.E. Aero Club's "Cygnet," the two machines performing in the air together.

A number of commercial aircraft then went up carrying full loads of passengers drawn from the more distinguished visitors to the aerodrome, and it is significant that, although several more machines than those originally scheduled to give "joy rides" were pressed into service, there were long queues of people lining up for each flight. The Armstrong-Whitworth "Argosy" was the type which "did most of the trade," and the manner in which this machine leaps off the ground and climbs almost like a scout is truly amazing, this, of course, being due to the reserve of power which arises out of the fact that the machine is designed not only to fly level but to climb with any one of its three engines stopped. The Handley Page "Hamlet" also "evoluted", but it was noticed that the whole of the flying was done with the slots open, so that although one got an excellent impression of how slow this machine can fly, one was unable to form an opinion of what sort of top speed it has with slots closed, although this is believed to be distinctly good, and probably even better than the figure of 118 m.p.h. given in FLIGHT recently.

While some of the visitors were tasting the joys of flying in modern passenger aircraft, others paid a visit to the hangars near the level crossing, where the control of aircraft operating on the cross-Channel routes as conducted in the aerodrome control tower was duplicated. A similar reproduction was made of the working of the air route meteorological service, while a very interesting exhibit was that of the Aircraft Operating Co., Ltd., and the Air Survey Co., Ltd., who illustrated the progress which has been made in air surveying. Much work has already been done by these companies in various parts of the British Empire. Thus it may be recollected that in South Burma an aerial survey of something like 15,000 square miles of forest was done in about three months' flying. By ordinary means a similar survey would, it is estimated, have taken several years. Forest stock maps were prepared on a 1-in. scale, which showed the boundaries between 13 different forest types, a subsequent check on the work carried out from the ground proving the boundaries to be very nearly as accurate as if they had been fixed by normal methods.



["FLIGHT" *Photograph*

80 TONS OF MATTER IN THE AIR: A squadron of Vickers "Virginia" night-bombers flying over the Croydon aerodrome in formation.

At the end of the passenger flights and the inspection of the various exhibits in the hangars the machines commenced taking off for their home stations, and it was then that one had an opportunity of seeing some of our more recent Service types in flight. Particularly impressive among these was the Fairey "Fox," the Fairey "Felix" engine of which emits a most reassuring note of a character likely to be music in the ears of a pilot. This sound is quite different from any given out by any British aero engine, and without seeing this machine one could easily identify it by the sound.

As we said last week, we sincerely hope that an opportunity will be afforded the Dominion representatives of going to some seaplane station in order to see the latest development in British marine aircraft. We understand that a visit will be paid to Cardington for the purpose of studying airship work, and we trust that time and opportunity may be found also for a visit to a seaplane station.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

October 28, 1926

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OUR CONTRIBUTORS

Mr. J. D. North, who was "missing" from the last issue of THE AIRCRAFT ENGINEER, returns to the attack this week upon problems connected with the stresses in aircraft in flight, more particularly in the wings. He calls attention to the somewhat unsatisfactory state of our present knowedge (or absence thereof) of the nature and magnitude of the various loads to which aeroplanes of different classes are subjected in flight, and points out the urgent need of experimental investigation, quoting passages from the 1922 report of the Load Factor Sub-Committee, and maintaining that the position in October, 1926, is practically the same as it was in January, 1922, since nothing appears to have been done towards obtaining the necessary experimental evidence.

Fig. 16 of Mr. North's article is interesting in showing that the maximum load factor on the wing spars occurs when the centre of pressure is at approximately one-third of the chord from the leading edge, a condition which is generally chosen in experimental testing abroad.

Mr. North then proceeds to examine the problem for what it is worth under conditions imposed at the present time, and point sout that the general expression for structure weight percentage does not cover the case of the wings, since some part of the forces on these is relieved by gravitational and inertia forces. He considers the case where the weight of the wings is made up of parts following the structure law and parts whose weight varies as $W^{\frac{2}{3}}$. The curves given for the two cases are interesting and should be closely studied.

Dr. Leslie Aitchison brings his very interesting and instructive series of articles on Duralumin to a close this week, and we feel certain our readers will join us in expressing to Dr. Aitchison our thanks for his valuable contribution to the general knowledge of the characteristics, peculiarities and treatment of this material which, in the view of many, is destined to become increasingly popular as a material for all-metal aircraft construction. We are aware that there are still those who are "afraid" of Duralumin, but such firms as have had most experience of it, among them being Short Brothers, have nearly always found their fears ill-founded, and we believe that Dr. Aitchison's articles will have done much towards a better understanding of the characteristics of this material.

AIRCRAFT PERFORMANCE.

Structural Policy in Design.

By J. D. NORTH, F.R.Ae.S.

(*Continued from p.* 77.)

The experimental evidence quoted in the last article may appear alarming in the light of English practice in regard to load factor; but, it must be remembered, the true strength figure (corresponding to the French "*Indice d'essai*") is higher than the specified factor or at least normally so, the amount being usually 15 per cent. under extreme centre of pressure conditions or as much as 30 per cent. with the centre of pressure in its most favourable position.

In the first case with the normal type of biplane structure, relief is obtained by redundancy through the incidence bracing. An approximation to the influence of the redundant members may be obtained by strain energy methods up to, roundly, half the failing load. Before actual failure takes place plastic extension of members, notably bracing wires, modifies the relative rigidity of the members composing the structure, causing relief to the overstrained members. We have here some protection from the possible detrimental influence of unconsidered redundancies and bad rigging. Where, however, stresses from these causes contribute to fatigue conditions, either actual alternating loads or by shifting the mean stress figure, failures will readily occur.

In the second case, it is evident that as the centre of pressure moves backwards, the load on the front spar decreases, and as it moves forward the load on the rear spar decreases. This is illustrated in Fig. 16. It will be observed that the maximum factor occurs with the centre of pressure roughly one-third of the chord from the leading edge, a condition frequently chosen in experimental testing, except under the English system.

Figures for experimental strength must therefore be carefully examined to ensure that they are on a common basis. This influence of centre of pressure on load factor does not affect the rest of the aeroplane in the same way as it does the wings. At the time when the wings have their maximum load factor the tail load is considerably less than in high speed conditions, *e.g.*, c.p. back and terminal nose dive; further, the scantlings of the rear portion of the fuselage are often determined by the tail skid load. The strength of the front part of the aeroplane is generally influenced by the under-carriage loads and engine installation over normal strength for flight conditions.

The nature and magnitude of the various loads to which aeroplanes of different classes are subjected in flight is in

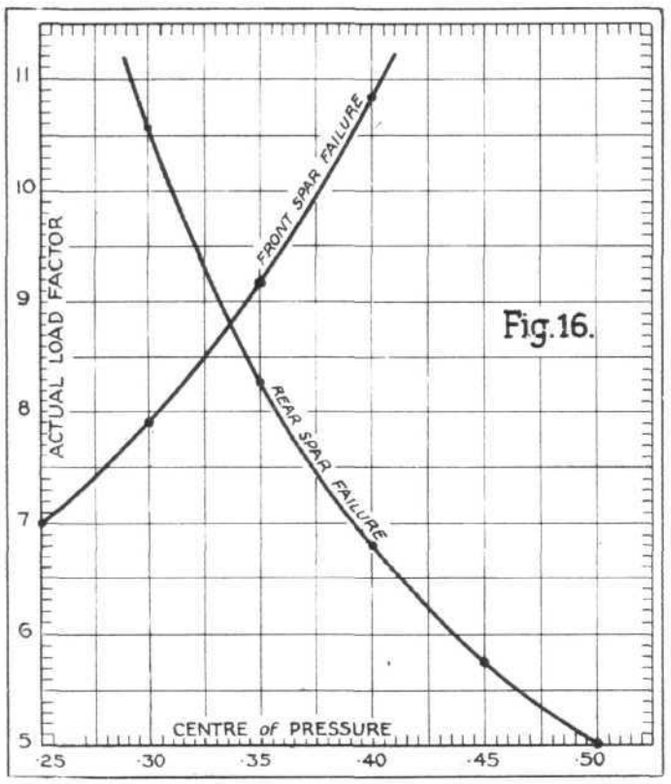


Fig. 16.—Effect of Centre of Pressure Travel on Load Factor of Wings.

Front and rear spars are assumed to be placed at 0·12 and 0·67 of the chord, measured from the leading edge. With the c.p. forward at 0·25 chord, the front spar has a factor of 7, and with the c.p. back at 0·50 chord the rear spar has a factor of 5.

As the c.p. moves back, the proportion of load carried by the two spars changes, as indicated below, the load factors following the changes. The maximum factor is 8·82, which is reached when the c.p. is at 0·336 chord.

C.P.	Load on—		Load Factor.	
Position.	Front Spar.	Rear Spar.	Front Spar.	Rear Spar.
0·25	0·764	0·236	7·00	14·62
0·30	0·673	0·327	7·93	10·57
0·35	0·583	0·417	9·16	8·28
0·40	0·492	0·508	10·86	6·80
0·45	0·401	0·599	13·32	5·76
0·50	0·309	0·691	17·28	5·00
0·336	0·607	0·393	8·82	8·82

urgent need of experimental investigation. In January, 1922, the position was summed up by the Load Factor Sub-Committee as follows :—

"In the past it has been the custom to calculate the stresses in an aeroplane under certain assumptions, in regard to the aerodynamic loading, which admittedly did not cover extreme conditions. The validity of the methods employed in calculation could be checked against the results of static tests made on a portion, or on the whole, of the structure, but no evidence for the accuracy of the assumptions could be adduced, beyond the general experience that machines stressed in this way, and designed with the factors of safety then customary, had proved strong enough in flight. This position is clearly not very satisfactory, in that everything which contributes to the strength or weakness of an aeroplane is taken indiscriminately into consideration.

"For a logical system of stressing it is necessary to know (1) the aerodynamic loading on the various parts of the machine ; (2) the strength of these parts ; and (3) an appropriate value of the factor of safety."

The position in October, 1926, is practically the same as it was in January, 1922, since nothing appears to have been done towards obtaining the necessary experimental evidence. The position with regard to centre of pressure coefficient is happier in that a method of calculation is now available which is reasonably accurate for all practical purposes. Past experimental evidence conflicting with calculations requires re-investigation, when much will be found, no doubt, to be of low evidential value.

The proposed scheme of factors of reliability and safety are too valuable to be neglected. The absolute values suggested need not be taken too seriously ; for example, the factor of safety chosen was probably largely due to the fact that two was the smallest whole number larger than one. No such scheme ought to result in heavier aeroplanes, rather in lighter structure for the same reliability, probability of failure. Pending this work, investigations as to influences of change of geometry and scale on structure weight are vested with an underlying unreality which is disconcerting to those desiring to make real progress.

We can, however, only examine the problem for what it is worth under conditions imposed today. In a previous article it was pointed out that the general expression for structure weight percentage

$$\frac{W_s}{W} = \alpha W^{\frac{1}{2}} + \beta + \gamma W^{-\frac{1}{2}} + \delta W^{-1}$$

does not cover the case of the wings since some part of the forces on them are relieved by gravitational and inertia forces. We may consider the weight of the wings with a fair degree of accuracy to be made up of parts following the structure law ($W^{\frac{3}{2}}$) and parts whose weight varies as W. Using the symbol $(W_p)_s$ for the former and W_p for the weight of the planes, this is expressed as

$$W_p = (W_p)_s + K\,W.$$

$$\therefore \quad \frac{(W_p)_s}{W} = \frac{W_p}{W} - K.$$

K is a constant depending on the design of the wings. Now, since the forces on them are relieved by the weight of the wings.

$$\frac{(W_p)_s}{W} = C.\left(1 - \frac{W_p}{W}\right) W^{\frac{1}{2}},$$

where C is a constant. The load factor (F) can also be introduced.

$$\frac{(W_p)_s}{W} = C\,F\left(1 - \frac{W_p}{W}\right) W^{\frac{1}{2}}$$

$$\therefore \quad \frac{W_p}{W} - K = C\,F\,W^{\frac{1}{2}} - C\,F\,\frac{W_p}{W}\cdot W^{\frac{1}{2}}$$

$$\frac{W_p}{W} = \frac{C\,F\,W^{\frac{1}{2}} + K}{1 + C\,F\,W^{\frac{1}{2}}}$$

which can be written

$$\frac{W_p}{W} = \frac{C\,F\,W^{\frac{1}{2}}}{1 + C\,F\,W^{\frac{1}{2}}}\,(1 - K) + K.$$

In Fig. 17 this expression has been plotted for some selected values of $\frac{W_p}{W}$ and $\frac{(W_p)_s}{W}$, as follows :—

$$W = 8{,}600 \quad \frac{W_p}{W} = 0{\cdot}160 \quad \frac{(W_p)_s}{W} = 0{\cdot}128$$

$$F = 5{\cdot}5$$

$$\text{from which } C = 0{\cdot}000299$$

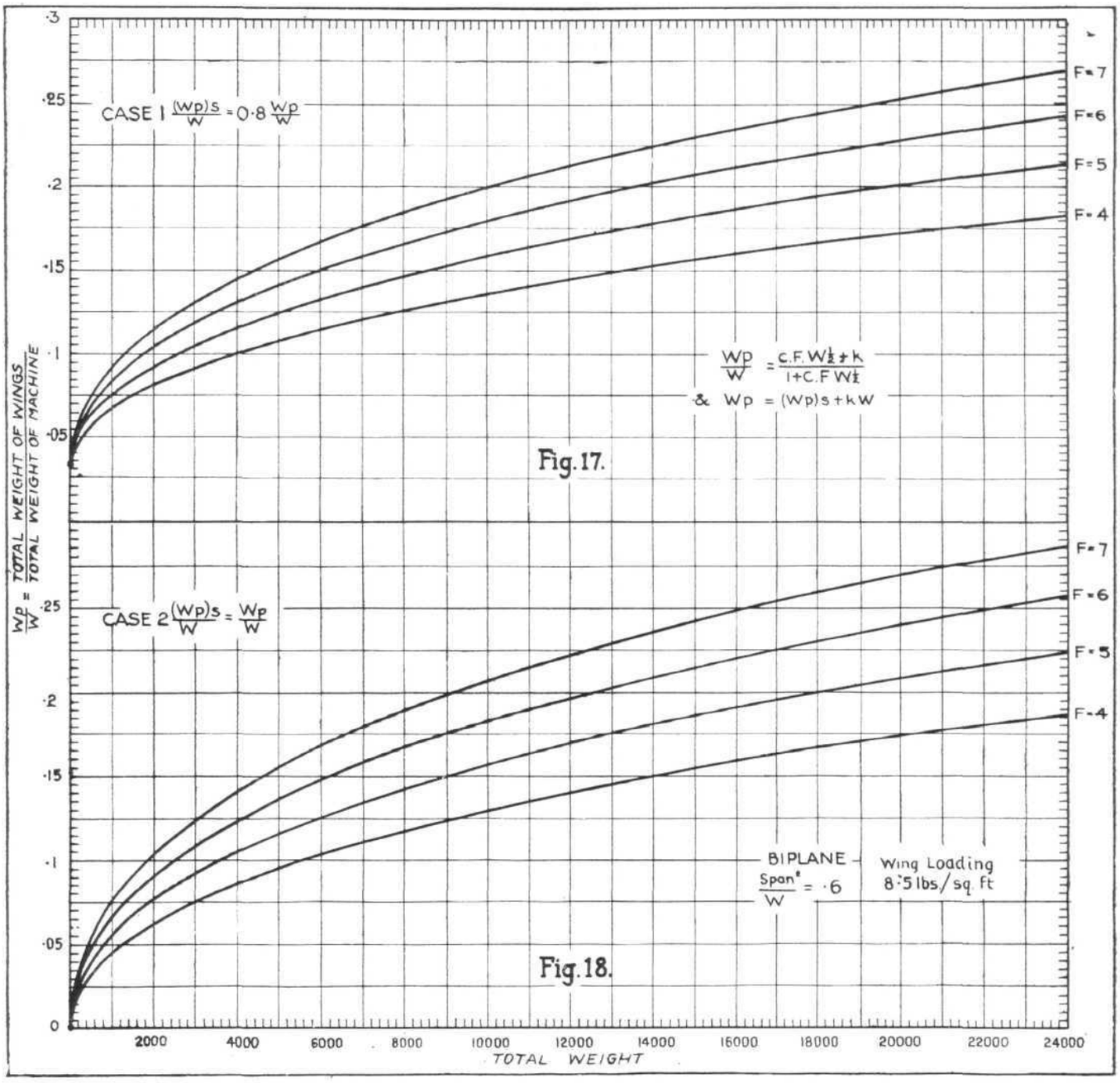
$$\text{and } K = 0{\cdot}032$$

and in Fig. 18

$$W = 8{,}600 \quad \frac{W_p}{W} = \frac{(W_p)_s}{W} = 0{\cdot}160$$

$$C = 0{\cdot}000373 \qquad K = 0.$$

In the second case the whole wing is assumed to follow the structure law, while the other constants more nearly represent practical construction. The curves are important as to their form rather than for their actual numerical value. They



correspond approximately to a value for $\frac{\text{Span}^2}{W}$ of 0·6 and a loading of 8·5 lb. per square foot. The effect of varying the loading on similar wings can also be illustrated. For example, take a machine of gross weight 10,000 lb., load factor 5, $\frac{\text{Span}^2}{W} = 0{\cdot}6$, loading 8·5 lb. per square foot. Change to $\frac{\text{Span}^2}{W} = 0{\cdot}5$, loading 10·2 lb. per square foot. In the first case the weight of the wings is 15·8 per cent. of the gross weight. Multiply the gross weight by the ratio of the $\frac{\text{Span}^2}{W}$ figures, *i.e.*, $10{,}000 \times \frac{5}{6}$ lb.

That is, 8,333.

Multiply the load factor by the inverse ratio,

i.e., $\quad 5 \times \frac{6}{5} = 6.$

The value of $\frac{W_p}{W}$ for 8,300 with load factor 6 is 0·168; multiply this by the ratio $\frac{5}{6}$ to express it as a fraction of the actual weight,

$$0{\cdot}168 \times \frac{5}{8} = 0{\cdot}14;$$

hence structure weight of the new wings is 14 per cent. against 15·8 per cent. for the original wings.

If the loading were to be kept constant so that there is a change of aspect ratio, the difference will be reduced. In the example considered the span was changed from, roughly, 77·5 to 71 ft., and the chord reduced from, roughly, 7·6 to just under 7 ft., whereas for constant loading the chord should be increased from 7·6 to 8·3 ft. The gap span ratio is assumed to remain constant (*e.g.*, about 0·11). As readers will remember from previous articles, this is the criterion of induced drag due to biplane effect.

The weight of wings may be considered as due to a structure of two parts: (*a*) the "span" structure, (*b*) the chord structure. The chord structure represents a much smaller proportion of wing weight and is less influenced by load factor and scale. The primary chord structure is merely represented by the drag struts and bracing, and the influence of changes in chord on spar loads, due to drag or drag components, as the latter is of opposite sign to the former, the influence of change of chord on the primary structure is small. The secondary chord structure is represented by the ribs and fabric—or rather, the effect on them of changes of

chord. Mr. W. D. Douglas has suggested* the form $W \times c/w$ = constant [where W = the weight supported in lb. w = the weight of the rib, c = the chord, and the constant varies between 6,300 and 3,500, according to design.

i.e., $w = \frac{W.c}{\text{constant}}$ and follows the structure law;

hence, if the weight supported by the rib remains a constant, the weight of the rib varies directly as the chord. To allow for the increase in chord to maintain constant loading, the weight of the rib must be increased in the ratio $\frac{8 \cdot 3}{7 \cdot 1}$, as must also the fabric and dope weight, which is nearly proportional to area. Appropriate figures, for example, would be 2·15 and 1·75 per cent. respectively—a total of 3·9 per cent. Deduct this from the 14 per cent. and add $\frac{8 \cdot 7}{7 \cdot 1} \times 3 \cdot 9$ per cent. = 4·55 per cent., giving a new figure of 14·65 per cent. for the structure of the wings with changed aspect ratio.

(To be continued.)

* International Air Congress, London, 1923. Report, page 210.

DURALUMIN

By LESLIE AITCHISON, D.Met., B.Sc., F.I.C., M.I.A.E.

(*Continued from p.* 81)

From what has been written previously, it is obvious that Duralumin is available to industry in a very considerable variety of forms. The metal is, in fact, produced in almost all the metallurgical forms except that of a casting. One or two points of special interest respecting the behaviour of the material in its different forms may be considered to be worth particular mention.

A good deal has been said about forgings and drop forgings in Duralumin, and the method of manufacture of such parts. In the machining of such parts no difficulties will arise if the material is treated, more or less, as though it was brass. The same speeds and feeds and tool angles as are used with brass will be found to give satisfactory results. The most satisfactory lubricant to employ is a mixture of paraffin and lard oil. It is desirable that alkaline solutions should not be employed as lubricants in the machining of Duralumin, and the medium suggested above will be found to be the most generally suitable one.

The same remarks as to machining apply to extruded and hammered Duralumin bars. Wherever possible, it is desirable to avoid the production of parts by machining them from particularly large sizes of bar. If a drop forging can be made, or even a rough forging, it will in general be found to be decidedly preferable to the machine-produced part. If they must be produced it is desirable that parts machined out from large bars should be heat-treated after rough machining, as otherwise there is bound to be an undesirable variation in the mechanical properties of the finished article.

The other class of extruded material, namely, sections of special shapes, is of conspicuous interest. Extruded Duralumin is pressed into shape and thereafter is heat-treated in the usual way to produce the requisite mechanical properties in the finished article. The extrusion process, of course, is carried out with hot metal, and the material is, therefore, shaped whilst it is in a very plastic condition. It is agreed that even during the extrusion process there will be a certain residuum of uneven strain set up in the material that remains after pressing, but this amount is quite small when compared with that produced by cold working. In any case, the residual strains are removed by the heat-treatment process. This means that in an extruded section the mechanical properties of the Duralumin are very uniform (excluding those very large sections in which there is a possibility of the mass effect in hardening becoming operative). This means that a section in which there are perfectly definite sharp corners is actually produced without any more strain remaining in the metal at the sharp corners than at positions markedly removed therefrom. This is a matter of some importance in design.

The corresponding type of section, namely, that known as "rolled and drawn," is of course, produced in a somewhat different way. In this case there is a severe cold deformation of the Duralumin, and consequently sharp corners are rather more to be avoided. Rolled and drawn sections may, of course, be produced from material that has just been quenched, *i.e.*, during the "soft period" in the normalising operation. If this method is chosen the material is not subsequently heat-treated, and some of the cold strains due to the shaping of the section are necessarily left in the finished metal. On the other hand, rolled and drawn sections can be produced from annealed metal and heat-treated after shaping. If this process is adopted, then the strains due to the cold working are evened up by the heat-treatment, and the resulting section is more or less as uniform in its mechanical properties as the extruded sections already described. There has, of course, been a severe straining of the metal during the cold-drawing operations, and the use of very sharp corners is always a possible source of danger at this stage.

The question is often asked as to how far it is reasonable to attempt to shape Duralumin in the cold after it has been heat-treated. Obviously, the same question arises in connection with the heat-treated high-tensile steels, or with mild steels, or even with brass, and in all cases the practical answer is much the same—namely, that the material can be distorted quite safely as much as it will stand without fracture. There is no more harm in working normalised Duralumin in this way than there is in working steel or brass, and the same rules will apply to all the metals. Obviously, however, if any of these materials are cold-worked they are bound to be strained by the cold work, and therefore, to be stronger or weaker to this extent than if they had not been cold-worked. There is nothing unusual about Duralumin in this regard. In practical engineering it is quite necessary for this type of work to be done, and when it has to be performed it will generally be found quite a safe guide to take that the material will withstand bending quite satisfactorily over a radius which is not smaller than three times the thickness of the metal. This refers to the material in the fully aged condition. If the metal is worked whilst in the "soft" condition immediately after quenching, a smaller radius can be negotiated.

Duralumin tubes are usually found to have a higher tensile strength than any of the other usual forms of Duralumin. As the maximum stress of the material in the tube form is higher, its ductility in tubes is less than in sheet or bar. The working of Duralumin tubes is a matter which is not very lightly to be undertaken. Most forms of shaped tubes can be obtained direct from the makers of the metal, and such operations as bending, flattening, and twisting are successfully performed by the manufacturers of the material.

Duralumin tubes can be flattened and can be expanded without serious difficulty, but the extent of these operations is necessarily limited by the ductility of the material, which, as stated above, is usually somewhat lower in tubes than in the other forms in which Duralumin is employed. The operation of flattening or expanding a tube is, of course, one in which the metal is stressed transversely, and the operations call for the material to distort the "worst" way of the grain, which is the direction in which the material is least capable of extension. In the ordinary way a Duralumin tube can be expanded without failure by an amount approximately equal to 20 per cent. of the diameter of the tube.

Although rolled and drawn sections and extruded sections can be produced in a state of uniform freedom from strains, despite the presence of sharp corners, this fact must not be allowed to cloud the issue with respect to the way in which these sections can subsequently be handled. If, for instance, an angle section is produced with a sharp corner either by the extrusion process or by rolling and drawing, it is in a perfectly satisfactory condition to use as it stands. If, however, attempts are made to flatten out the angle, the presence of the sharp corner will necessarily make itself felt and will cause difficulty in the flattening operation. The probable result will be that the angle will crack through the sharp corner. If, therefore, any such operations are likely to be carried out on the material after it has been hardened

(*i.e.*, normalised), the section should be produced with an adequate radius in the corner, and should not be obtained "sharp."

In the construction of articles from Duralumin it is customary to rely upon riveted joints. It would, of course, be a particularly convenient thing under many circumstances if welded or soldered joints could be made in the metal and relied upon. The application of either of these two processes to Duralumin presents certain difficulties. The soldering of Duralumin suffers from all the disadvantages that are generally encountered in carrying out this operation on aluminium or light alloys. It can probably be said quite accurately that the difficulties of soldering Duralumin are scarcely different from those met with in the soldering of aluminium. It is known that aluminium can be soldered with more or less success, but that the soldered joint can only be used with satisfaction under certain definitely defined conditions. It is no good to expect the joint to be strong, and soldered joints in Duralumin should, therefore, be reinforced by riveting. Furthermore, those solders which are applied to the naked Duralumin are very frequently such as lead to ready and rapid corrosion.

The welding of Duralumin follows somewhat on the same lines, but there are certain features that are not met with in the welding of plain aluminium. Naturally, Duralumin that has to be welded must necessarily be heated to a high temperature, sufficiently high to reduce the mechanical properties of the normalised Duralumin approximately to those of annealed Duralumin. This refers to the condition of the material at and in the vicinity of the weld. In the second place, a welded joint in Duralumin has the same characteristic as a weld in any other material—namely, that it is the result of what is more or less a casting operation. This necessarily means that the material at the weld has approximately the ductility of a cast metal. (The same remarks apply to welded steel structures. The material that is used for filling in is applied in the molten condition and, therefore, is to all intents and purposes cast into position. A welded-steel joint, therefore, is similar in properties to a steel casting, and after normalising the joint is similar in properties and structure to those of a normalised steel casting.) It will be safe to infer, therefore, that welded Duralumin joints are only likely to become really useful when joints of sufficient excellence can be produced that the whole article can subsequently be submitted to the heat-treatment operation. This naturally limits very considerably the useful application of welding to Duralumin structures.

In conclusion, it may not be out of place to make some remarks as to the sources of supplies of Duralumin. Naturally, the aircraft industry in particular is concerned to know whether Duralumin is likely to be available in adequate quantities in the event of a war, and more particularly in the event of a war of the magnitude of the last one. The only serious question which arises in this connection is whether there would be adequate supplies of the necessary raw materials for the production of Duralumin in the quantities that would be required. This narrows itself down to a consideration of the supply of aluminium, copper, manganese and magnesium.

There is no need to enter into the question of the supply of copper and manganese, and the inquiry can, therefore, be narrowed down to magnesium and aluminium. Both of these materials are produced in this country in quantities. The quantity of magnesium required for the manufacture of Duralumin is not very large compared with that which would be consumed in other directions in warfare, and the existing capacity for its production in this country is quite equal to any demand that is likely to be made upon it by the aircraft industry and the others who would use Duralumin in wartime.

Aluminium is being used every day in greatly increased quantities in various directions, and the British makers of aluminium are having to cope with a demand that is steadily growing. In the event of a war, of course, the output of these suppliers would naturally be concentrated upon satisfying the needs of the fighting services. At the present time the British suppliers are able to manufacture quite as much aluminium as would be likely to be required by the aircraft industry in a war of the same scale as the last, but they are, as is well known, increasing their capacity for production very considerably, and it is quite clear that the available supplies of aluminium will be more than equal to the aeronautical requirements of the country in the event of war, even taking into account the considerable quantity that would be employed in other branches of warfare. This is not the place in which to give the data that would prove this statement, but the facts, nevertheless, remain as stated. The only question that remains, therefore, is that of the availability of sufficient raw material from which aluminium manufacturers can produce the metal. In other words, the supply of ore must be quite adequate.

As is well known, aluminium is produced from a mineral called bauxite. Various grades of this material exist, and in different qualities it is distributed very widely over the surface of the globe. Large quantities of bauxite, possibly the predominant proportion of the usefully workable supplies, are located in the British Empire, and are, therefore, available to this country in the event of a war, which might possibly remove the European supplies of the material from the British manufacturers. It is agreed that all these sources of supply are not equal in quality, but there is certainly quite enough in the British Empire of the best quality to produce the requisite aluminium.

Fortunately, perhaps, bauxite has to undergo very special processes of purification before it can be reduced to aluminium, and as a result the aluminium manufacturers are bound to maintain a very large quantity of the ore at, or in the vicinity of, their reduction furnaces. This would mean that in the event of a sudden outbreak of war, resulting in a temporary dislocation of the merchant marine, the aluminium-producing companies would not be left short of the supplies of the necessary raw material. It appears to be quite safe to say that they would be able to continue for many, many months without hindrance in the production of aluminium to their full capacity, even though not an ounce of bauxite reached these shores from the deposits overseas.

It becomes plain, therefore, that in all the links of the chain the circumstances are such as would ensure a continuous supply of aluminium for the production of Duralumin. The other constituents of the alloy are available from home supplies, and, therefore, it is evident that in the event of a war, even of great magnitude, supplies of Duralumin would be quite adequate for the needs of the Air Ministry, even though this was based upon an "all-Duralumin" programme.

TECHNICAL LITERATURE.

A.R.C. REPORTS.

AN INVESTIGATION OF THE FLOW OF AIR AROUND AN AEROFOIL OF INFINITE SPAN.*

By L. W. BRYANT, B.Sc., A.R.C.Sc., and D. H. WILLIAMS, B.Sc., with an Appendix by G. I. TAYLOR, F.R.S.

R. and M. No. 989 (Ae. 200). (44 pages, 20 figures.) February, 1924. Price 1s. 9*d.* net.

A great deal of attention has been directed of late years to the development of a rational theory of the aerofoil. Prof. L. Prandtl and others in Germany have applied the principles of the hydrodynamics of a perfect fluid to the aerofoil with remarkable results, whilst investigators in this country have extended this work and have verified experimentally many of the deductions of the Prandtl theory. The assumptions underlying the work of Prandtl are, however, of uncertain validity, and it has become a matter of great importance to add to existing experimental evidence of the fundamental characteristics of the motion of a viscous fluid round an aerofoil. With this purpose in view an aerofoil section of fairly high lift coefficient was selected, and a model of it tested in the duplex tunnel at the National Physical Laboratory, the field of flow being thoroughly explored with a wind-velocity meter. At the same time the theoretical stream-lines corresponding to inviscid fluid flow were determined experimentally, as described in Part II of this paper.

* Royal Society, A., Vol. 225, November, 1925.

The case considered is that of an aerofoil of infinite span, the flow being two-dimensional. A comparison was made of the theoretical and experimental distributions of pressure over the surface of the aerofoil, as well as of the two sets of superposed stream-lines.

The work has provided an experimental verification of the law of Kutta and Joukowsky, that the product of the mean velocity and density of the fluid and of the circulation (according to the hydrodynamical definition of this term) around a contour enclosing the aerofoil is equal to the lift of the aerofoil (per unit length). It has further shown that the circulation around the aerofoil is constant within the limits of experimental error and independent of the contour of integration chosen, provided that the contour line does not at any part approach too near to the aerofoil, and also that it cuts the trailing "wake" approximately at right angles to its core. The lowest value of the circulation found (calculated for a contour as close to the aerofoil surface as the observations permitted) was about 6½ per cent. less than the value corresponding to the lift coefficient; this is hardly outside the limits of experimental accuracy in the neighbourhood of the aerofoil.

The theoretical streamlines were calculated on the assumption that a circulation existed corresponding in magnitude to that observed experimentally. Under these conditions there is no evidence that the experimental front stagnation point differs in position sensibly from the theoretical one. The rear stagnation point is indeterminate, and, in fact, meaningless, in the experimental field; and, indeed, the extremely unsteady and turbulent character of the flow over the rear part of the upper surface and onwards points to a near approach to the "stalling" or "burbling" condition.

THE BEHAVIOUR OF SINGLE CRYSTALS OF ALUMINIUM UNDER STATIC AND REPEATED STRESSES.* PARTS I, 2 AND 3.

By H. J. GOUGH, M.B.E., B.Sc., D. HANSON, D.Sc., and S. J. WRIGHT, B.A.

Work Performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 995 (M. 32). (54 pages, 24 photographs, 26 figures.) November, 1924. Price 3*s.* 6*d.* net.

Metals as ordinarily used in practice are in the form of "crystalline aggregates" made up of large numbers of small crystals separated by boundaries. It is sometimes thought that these boundaries consist of "non-crystalline" or "amorphous" material. In view of the fact that little or nothing is known of the influence of these boundaries on the observed fatigue phenomena it was considered that the general problem of failure of metals should first be attacked by an investigation into the behaviour of the crystals themselves. An investigation of this nature was therefore undertaken at the National Physical Laboratory, the test specimens employed being cut from "Single Crystal" bars of aluminium. The present report deals with the results so far obtained, together with a discussion of certain conclusions drawn from them. It should be mentioned that work on Non-Crystalline materials is being carried out elsewhere by Professor Jenkin and by Dr. A. A. Griffith.

The report deals with the changes in micro-structure, and the deformation and fracture of single crystals of aluminium subjected to:—

(1) Rapid reversals of direct stresses;
(2) Reversals of torsional stresses;
(3) Slow cyclic repetitions of tensile; and
(4) Single blow impact-tensile tests.

Mechanical, microscopical and X-ray methods have been employed and the results of all these methods of investigation have been correlated.

The crystals possessed no primitive limit; the hysteresis effects observed in the tensile tests were in all respects similar to those obtained in tests on crystalline aggregates.

Under all ranges of stress, slip-bands were observed and were identified as the traces of actual slip-planes on the surface of the specimen. These slip-planes were found to be in very close agreement with the octahedral planes of the crystals. The slip-bands resulting from the application of low ranges of stress were much straighter and more regular than those occurring under higher ranges.

Deformation proceeded by slipping on these planes, the particular octahedral planes playing the major part in the distortion being that set which was most nearly parallel to a plane of maximum shear stress. Further the direction of slip on these planes coincided with that of the most highly stressed principal lines of atoms.

Very marked hardening effects were produced by slip. A consideration of these and other effects led to the conclusion that slipping caused a distortion or "rumpling" of the slip-planes. On this conclusion a theory of slip and of the rupture of crystalline materials has been based and is presented in Part III of the report.

It is considered desirable to make some further tests of the same nature as those described in this report—particularly some further tests under reversed torsional stresses. In addition it is hoped:—

(1) To obtain direct experimental evidence of slipping in the reversed direction on planes parallel to the original slip-planes, during the unloading part of direct stress cycles in which the mean stress is tensile.

(2) To obtain information as to the influence of the crystal boundaries by tests on specimens consisting of two or three distinct crystals.

* Previously published in Royal Society Phil. Trans., A, Vol. 226, pp. 1-30, 1926.

FULL-SCALE AND MODEL MEASUREMENTS OF LIFT AND DRAG OF BRISTOL FIGHTER WITH R.A.F. 32 WINGS.

By E. F. ANDERSON, B.Sc., and L. E. CAYGILL, B.Sc.
Presented by the Director of Scientific Research.

R. & M. No. 1006 (Ae. 212). (5 pages and 6 diagrams.) December, 1925. Price 6*d.* net.

This report continues the series of model and full-scale comparisons of the lift and drag of biplanes using thick section wings, the method of experiment being the same as that described in R. & M. 859.*

The lift and drag of a Bristol Fighter aeroplane with wings of R.A.F. 32 section have been determined both on the full-scale aeroplane and on a 1/10th scale model at speeds of 40, 60 and 90 ft./sec.

The maximum lift coefficient is higher for the full-scale aeroplane than for the model, but the increase is not so large as for R.A.F. 31. The drag coefficient is considerably lower on the full-scale than on the model, particularly at minimum drag.

A Bristol Fighter aeroplane with R.A.F. 30 wings will shortly be tested, and measurements will be made on a model for comparison. (*See also* R. & M. Nos. 928† and 946‡.)

* R. & M. 859.—Lift and drag of the Bristol Fighter with wings of three aspect ratios.—Aerodynamics Staff, R.A.E.

† R. & M. 928.—Test of four thick aerofoils, R.A.F. 30, 31, 32 and 33.—Brafield and Hartshorn, R.A.E.

‡ R. & M. 946.—The theory of the design of aerofoils, with an analysis of the experimental results for the aerofoils R.A.F. 25, 26, 30 to 33.—Glauert, R.A.E.

FULL-SCALE AND MODEL MEASUREMENTS OF LIFT AND DRAG OF BRISTOL FIGHTER WITH HANDLEY PAGE SLOTTED WINGS.

By E. T. JONES, B.Eng., and L. E. CAYGILL, B.Sc., A.M.I.M.E.

R. & M. No. 1007.—(Ae. 213). (9 pages and 12 diagrams.) December, 1925. Price 9*d.* net.

This report extends the range of the comparison of full-scale and model measurements of lift and drag on complete aeroplanes to the case of the slotted wing, and the results have been compared with those on the standard aeroplane reported in R. & M. 897.§

§ R. & M. 897.—The lift and drag of a standard Bristol Fighter aeroplane.—By the Staff of the R.A.E.

A Bristol Fighter was fitted in succession with two sets of auxiliary leading aerofoils chosen as the result of tests carried out by Messrs. Handley Page in their wind tunnel on a model monoplane. The main wing section, to the rear of the front spar, was standard, and the front portion and leading aerofoils were shaped so that if the slot were closed a good high-speed section would be formed. No experiments were carried out with slot closed, the object of the test being to determine scale effect on lift and drag in the neighbourhood of the maximum lift.

In the case of the small leading aerofoil the full-scale and model maximum lift coefficients are in agreement at 0·74. With the large leading aerofoil, however, the full-scale reaches 0·85, as compared with 0·77 for the model. The model drag coefficient is about 0·007 higher than the full scale in both cases.

The experiments are being extended to compare the centre of pressure and downwash in the case of the large leading aerofoil. These data are required for the calculation of tail settings.

EXPERIMENTS ON THE FLOW BEHIND A ROTATING CYLINDER IN THE WATER CHANNEL.

By E. F. RELF, A.R.C.Sc., and T. LAVENDER.

R. & M. No. 1009.—(Ae. 215). (2 pages and 11 diagrams.) May, 1925. Price 9*d*. net.

The Flettner Rotor Ship has brought before the public one practical method of using the special properties of a rotating cylinder in a wind, these properties have been studied in various laboratories to find the aerodynamic efficiency of the cylinder. The present report describes a visual study in water and gives a number of photographs which show clearly the development of an increasing circulation as the rotational speed of the cylinder increases. Owing to the small scale of the available apparatus, no conclusions could be drawn as to the behaviour of the flow from the experiments at the higher rotational speeds.

ON THE DRAG OF AN AEROFOIL FOR TWO-DIMENSIONAL FLOW.

By A. FAGE, A.R.C.Sc., and L. J. JONES.

R. & M. No. 1015.—(Ae. 218). (14 pages and 3 diagrams.) November, 1925. Price 7*d*. net.

According to modern aerofoil theory, the drag of an aerofoil of finite span is compounded of two parts, one a profile drag associated with the shape and attitude of the section, and the other an induced drag connected with the variation of lift along the span. The magnitude of this induced drag can be determined when the forces acting on the aerofoil are known. As the span increases, the profile drag per unit length approaches a limiting value, whereas the induced drag becomes relatively smaller, because of the more uniform distribution of lift, and would disappear completely if the span were infinite. The present paper deals exclusively with the profile drag of an aerofoil of infinite span, or, in other words, the drag for two-dimensional flow.

The experiments were made on an aerofoil of 0·5 ft. chord mounted in a 4-ft. wind tunnel, with small clearances between the tips and the tunnel walls (0·15 in.). Preliminary observations of total head showed that the wake was uniform along the span, except in the neighbourhood of the walls, where it opened out appreciably.

Observations of the normal components of the pressure around the median section of the aerofoil have been made, and it has been estimated that in the neighbourhood of minimum drag they account for about 80 per cent. of the total drag. For this particular aerofoil, therefore, the surface tractions contribute about 20 per cent. of the total drag.

Included in the paper is a comparison between the drag for two-dimensional flow predicted by the Prandtl theory from force measurements on an aerofoil of rectangular plan form, the ratio of span to chord being 6 : 1, and that estimated from the total-head losses in the wake; the agreement is close, except at large incidences, where the discrepancy is of the order of 10 per cent.

Finally, observations of pressure and velocity taken in the wake at some distance behind the aerofoil (0·68 chord), show that most of the total head losses can be accounted for by a decrease of velocity, and that the pressure does not differ appreciably from that measured in the surrounding stream.

REPORT ON DOPES AND DETONATION.

By Professor H. L. CALLENDAR, C.B.E., F.R.S., Assisted by Captain R. O. KING and Flying Officer C. J. SIMS. Communicated by the Director of Scientific Research.

R. & M. No. 1013.—(E. 18). (54 pages, 15 figures.) November, 1925. Price 2*s*. net.

The investigations forming the basis of this report were undertaken at the Air Ministry Laboratory by request of Mr. H. E. Wimperis, then Acting Director of Scientific Research, who arranged for the experimental work to be directed by Professor Callendar and allocated suitable engine equipment to the Laboratory, following the submission by Professor Callendar of the nuclear theory of detonation.

The primary object of the investigation was the determination of the physical actions that delay or prevent detonation in an engine cylinder.

Such laboratory and engine experiments as were considered necessary to test the nuclear theory of detonation have been carried out, and, in addition, previous work bearing on the phenomena of detonation in engine cylinders has been reviewed.

The nuclear theory of detonation explains generally the action of dopes in delaying detonation, certainly to the extent that it may be taken as a guide in searching for anti-detonating substances free from the objectionable characteristics of the metallic dopes, and not subject to limitation of supply in time of emergency.

It is suggested that trials of metallic dopes should be made at higher engine compression pressures, and that the investigation of non-metallic dopes might be continued with the object of finding effective anti-detonating substances other than benzene derivatives. These trials will shortly be put in hand.

AN EXPERIMENT TO DETERMINE IF SLIP CAN BE DETECTED DURING THE UNLOADING PORTION OF A CYCLE OF REPEATED TENSILE STRESSES.

By H. J. GOUGH, M.B.E., B.Sc., S. J. WRIGHT, B.A., and D. HANSON, D.Sc.

Work Performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1022.—(M. 38). (6 pages and 6 figures.) December, 1925. Price 6*d*. net.

The object of the present experiment was to determine whether any plastic deformation could be detected as the result of the unloading part of a cycle of repeated tensile loading.*

An apparatus was designed by means of which a test piece could be stressed in tension, and could be examined and repolished while under load. The load being then released, a further examination could be made. Any changes in microstructure due to the unloading could thus be isolated from those occurring in the remaining portion of a complete cycle.

No change in microstructure could be detected as a result of one unloading of a single crystal of aluminium from a stress of 1·78 tons/sq. in. On the other hand, no change could be detected when the specimen was *re-loaded* to the same stress, although a multitude of slip bands resulted from 100,000 further cycles. Consequently, the results of the experiment prove only that the amount of plastic strain which occurs in any one cycle after the first, at the range of stress used, is not sufficient to be detected under the microscope.

It is proposed to repeat the present experiment on further specimens using a much higher maximum stress. Similar work will also be performed on crystalline aggregates.

* The more general investigation has been published under the title, "Behaviour of Single Crystals of Aluminium under Static and Repeated Stresses."—Gough, Hanson and Wright. Phil. Trans., Roy. Soc., Series A, Vol. 226, pp. 1–30, 1926, and R. & M. 995.

THE EFFECT OF METALLIC SOLS IN DELAYING DETONATION IN INTERNAL COMBUSTION ENGINES.

By Flight-Lieut. C. J. SIMS, D.F.C., D.I.C., R.A.F., assisted by Dr. E. W. J. MARDLES, F.I.C.

Presented by the Director of Scientific Research. R. & M. No. 1021 (E. 19). 11 pages. May, 1926. Price 6*d*. net.

The experimental work with metallic sols was undertaken as part of the Air Ministry Laboratory investigation of the cause of detonation in carburettor engines. A more general investigation has been published in R. & M. 1013 under the title of "Reports on Dopes and Detonation" by Professor Callendar.

The investigation of the action of metallic sols as small additions to engine fuel has included trials of as many such sols as it has been found possible to prepare.

It has been found that colloidal solutions of iron, lead and nickel in petrol are as effective in delaying detonation as the organo compounds of these metals. Metallic iron seems to be more effective than its carbonyl compound.

It is proposed to continue experimental work with metallic sols with a view to obtaining evidence as to the manner in which they act in delaying detonation.

THE ANALYSIS OF EXPERIMENTAL RESULTS IN THE WINDMILL BRAKE AND VORTEX RING STATES OF AN AIRSCREW.

By H. GLAUERT, M.A.

R. & M. No. 1026 (Ae. 222) (8 pages and 2 diagrams). February, 1926. Price 3*d*. net.

The vortex theory of airscrews, as developed in reports R. & M. 786* and 869,† determines the behaviour of an air screw under ordinary working conditions, but breaks down in the vortex-ring state and in part of the windmill-brake state. The theory may be represented in the form of a characteristic curve connecting two non-dimensional parameters F and *f*.

An attempt to extend the theory empirically and by means of certain general theoretical arguments has been made in report R. & M. 1014,‡ and this discussion has revealed the general nature of the characteristic curve in the region where the vortex theory breaks down. The experimental data have been analysed in the present report to determine the form of the characteristic curve in the regions where the vortex theory is inapplicable or inaccurate.

An empirical form of the characteristic curve has been determined which fits the experimental data and joins on to the theoretical curves in the propeller and windmill-brake states. The exact form of the curve will remain somewhat uncertain until the tunnel interference is known accurately or until further experiments are available from an open jet tunnel.

* R. & M. 786.—An aerodynamic theory of the airscrew.—Glauert, R.A.E.

† R. & M. 869.—Notes on the vortex theory of airscrews.—Glauert, R.A.E.

‡ R. & M. 1014.—An extension of the vortex theory of airscrews with applications to airscrews of small pitch and including experimental results.—Lock, Bateman and Townend, N.P.L.

HYDROGEN AS AN AUXILIARY FUEL FOR A SOLID INJECTION OIL ENGINE.

By G. F. MUCKLOW, M.Sc. COMMUNICATED BY PROFESSOR A. H. GIBSON.

R. & M. No. 1029 (E. 20) (16 pages and 17 diagrams). April, 1926. Price 1*s*. net.

The report deals with experiments carried out in the Engineering Laboratories of the University of Manchester, on a Crossley solid-injection oil engine, in which small quantities of hydrogen and coal gas were introduced along with the air supply to the engine. The engine has a bore of 14 in., a stroke of 23 in., and a normal speed of 211 r.p.m. Its normal rating is 66 b.h.p.

References are made to the work of Dixon, Riedler, Wollers and Ehencke. Watson (Proc. Inst. Mech. Eng., May, 1912), and Fenning (R. & M. No. 979, May, 1924).

Three series of trials were run with hydrogen, each at a different load, viz., 53·4, 39·4 and 24·4 b.h.p. The maximum amount of hydrogen used was slightly more than 3 per cent. by volume of the air supply, corresponding, at the lightest load, to some 14 per cent. by weight of the oil fuel supply.

Three corresponding series of trials were run, using coal gas in place of hydrogen, the maximum volume of gas employed being 5 per cent. of the air supply. At the lightest load this corresponds to approximately 2·4 times the weight of fuel oil used.

Such quantities of hydrogen or coal gas can be used satisfactorily in the type of engine considered. No trouble was experienced due to pre-ignition or other causes, and the engine appeared to run more sweetly when gas was being used.

When running at constant load and speed, the admission of small quantities of gas appears to cause combustion to take place at a slower rate, giving a lower maximum pressure and more burning down the expansion stroke. The thermal efficiency is in consequence slightly reduced, while the heat losses to the exhaust are increased.

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C. 2; 28, Abingdon Street, London, S.W.1; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; and 120, George Street, Edinburgh; or through any bookseller.

THE ELEMENTS OF AEROFOIL AND AIRSCREW THEORY.

Very considerable strides have been made during the last few years in the development of a theory which would fit the observed phenomena connected with the action of a gas on a solid body such as an aerofoil, but it is rather strange that, although some of the earliest work on this subject was due to an Englishman, Mr. F. W. Lanchester, the development of the theory has been largely left to other nations, Germany in particular having contributed a great deal. Not only so, but it is to be feared that the work that has been going on abroad has not received at home the close and general attention which it deserved. Doubtless this is due in the main to the language difficulty. An excellent book on the subject of aerofoil theory was published in German some years ago,* but an English text-book on modern aerofoil theory has hitherto been lacking. It is therefore vastly more true of the new book by Mr. H. Glauert than is usually the case when the hackneyed phrase is used that it "fills a long-felt want." "The Elements of Aerofoil and Airscrew Theory," by H. Glauert, published by the Cambridge University Press at 14*s*. net, literally does "fill a long-felt want," and fills it in a manner wholly commendable. A very obstruse and learned exposition would have appealed to but a very few, but by writing it so as "to give an account of aerofoil and airscrew theory in a form suitable for students of aeronautical engineering who do not possess a previous knowledge of hydrodynamics," the author has rendered his book accessible to a vastly wider circle of readers.

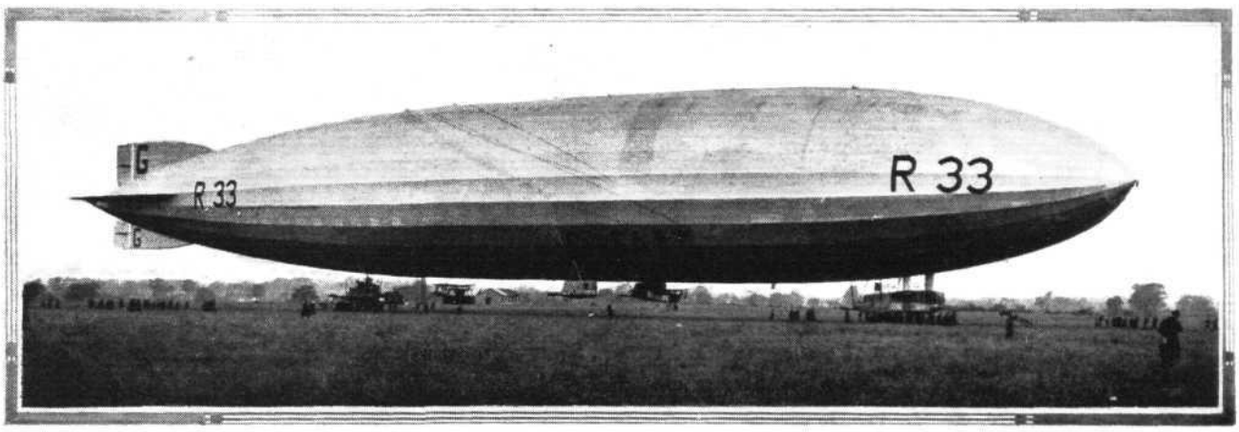
Not that it should be assumed that Glauert's book is "easy reading." It is not, and the author does not profess to tell one all about aerofoil theory in "non-technical language." Had he claimed to do so, one would have looked upon the book with mistrust. As it is, complex mathematical analysis has been avoided as far as possible, and the book contains only the very minimum of "mathematics" necessary to the statement and explanation of the theory. The first five chapters give a brief introduction to those aspects of hydrodynamics which are required for the development of the theory. The following chapters deal with the lift of an aerofoil in two-dimensional motion, with the effect of viscosity and its bearing on aerofoil theory, and with the theory of aerofoils of finite span. The last three chapters deal with airscrew theory.

* "Aerodynamik," by Richard Fuchs and Ludwig Hopf. Published by Richard Carl Schmidt & Co., Berlin, 1922.

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

R.33 AS AIRCRAFT CARRIER

ON October 21 last the British rigid airship R.33 carried out some further tests in connection with the airship development programme. The main feature of these tests, which were made at Pulham airship station, consisted in some further experiments in launching aeroplanes from the airship during flight. Previous experiments in this direction, it will be remembered, were carried out with a single D.H.53 light monoplane, which, piloted by Sq.-Ldr. Rollo Haig, was successfully launched from, and re-attached to, the R.33. itself, as regards the effect of the sudden release of a comparatively heavy load. In this connection it should be noted that each of the Gloster "Grebes" weighed over a ton, and that each represented about 40,000 cub. ft., out of the total 2,000,000 cub. ft. of gas required by R.33, so that it was quite conceivable that the sudden extra lift thus gained by the airship, together with the release of load from a point forward, or aft, of the airship's centre of gravity, would have considerable disturbing effect upon the airship's trim. As a



["FLIGHT" *Photograph*

H.M. AIR AIRCRAFT CARRIER, R.33: The British rigid airship, R.33, with two Gloster "Grebes" attached, just before ascending from Pulham on October 21.

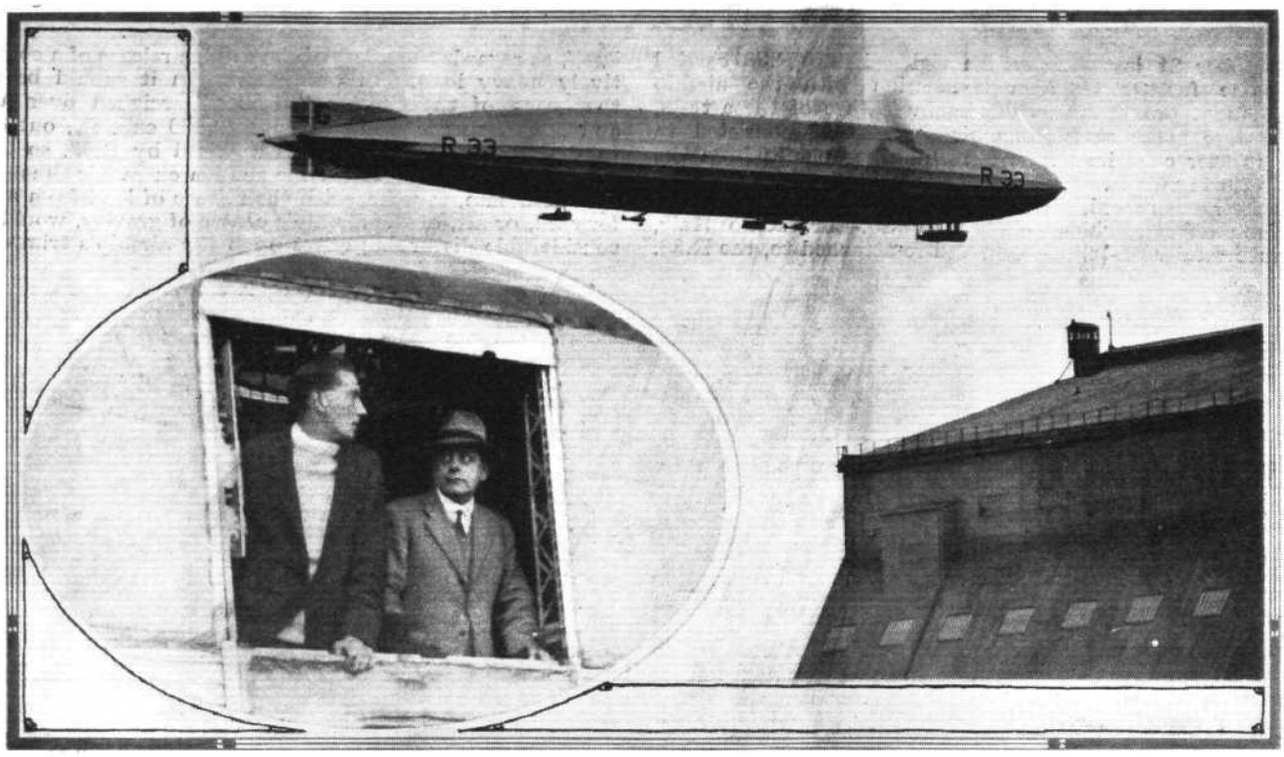
This time, however, the experiment was developed still further, and instead of carrying one light 'plane, the R.33 ascended with two standard Gloster "Grebe" single-seater fighters (Armstrong-Siddeley "Jaguars") slung beneath her hull.

One of these machines was "released" at Pulham and the other at Cardington, where R.33 proceeded shortly after. The objects of the present experiment were: firstly, to demonstrate the possibility of employing the airship as an aircraft carrier under more practical and useful conditions than hitherto—and the experiment has certainly shown that it should be quite feasible for a number of up-to-date aircraft to be transported speedily to distant parts and successfully launched. Secondly, it also served as a test of the airship matter of fact, when the first "Grebe" cast off, R.33 proceeded on her way entirely unperturbed—at least, not appreciably so, to those watching on the ground below.

After a "retirement" of about a year, R.33 emerged from her shed at Pulham shortly before 9 a.m. on Thursday last, weather conditions at the time being good. Maj. G. H. Scott was in command, with Sq.-Ldr. R. Booth—who accompanied R.33 on her "night out" last year—as second in command, Capt. W. Meager third officer, and Flight-Lieut. Johnston as navigator. On board were also Group-Capt. P. F. M. Fellowes, Director of Airship Development, Wing-Comdr. W. L. Welsh, of the Flying Operations Section, Air Ministry, and Mr. W. W. Smith, of the Air Defence Experimental Establishment, Biggin Hill (in charge of acoustica

["FLIGHT" *Photograph*

"LIGHTER-HEAVIER-THAN-AIR": A close-up of the R.33 (or part of same) and the two Gloster "Grebes." Each of the latter weighed over a ton, and were successfully launched from about 2,000 ft.

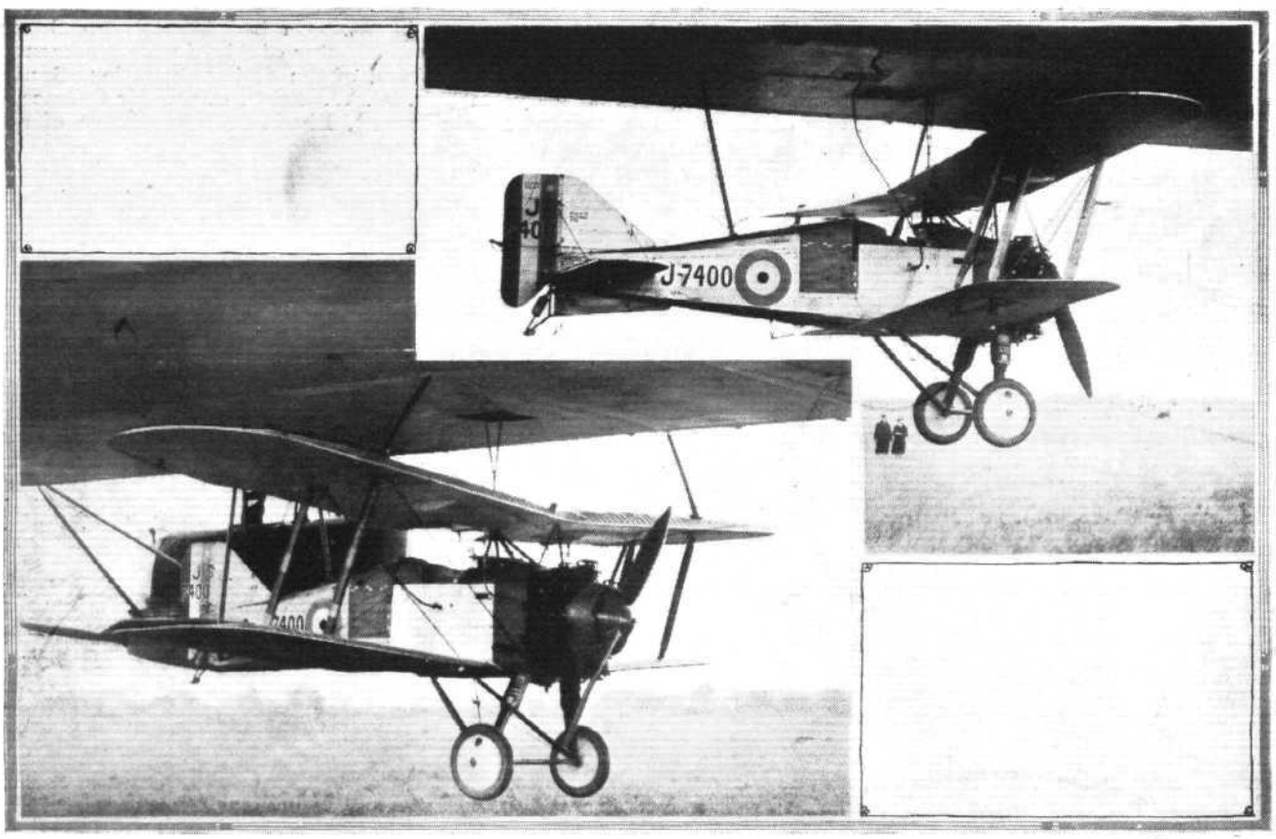


["FLIGHT" *Photographs*

H.M. AIR AIRCRAFT CARRIER, R. 33.—The R. 33 takes the air (with two Gloster "Grebes") once again after a year's rest. Inset, Major G. H. Scott, who was in command, and his second officer, Squad.-Leader R. Booth, in the control car.

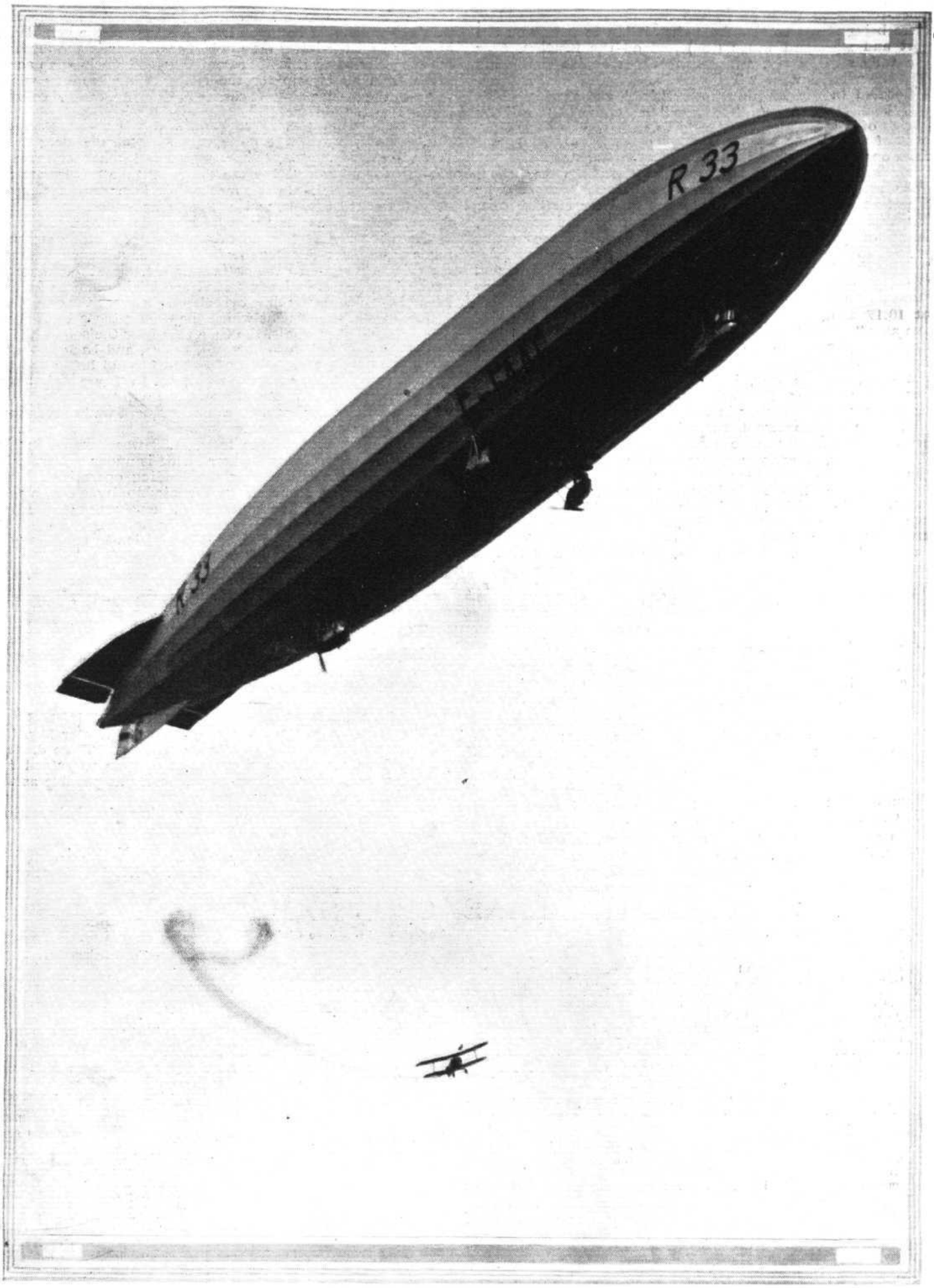
experiments. In all, the total personnel amounted to 35 persons, to which load must be added about 2¼ tons for the two aeroplanes. The pilots of the two "Grebes," Flying Officers R. L. Ragg and C. Mackenzie-Richards—both of the Royal Aircraft Establishment—were, of course, also on board.

The two "Grebes" were suspended from the keel of the airship—one just forward of the two front engine nacelles.



["FLIGHT" *Photographs*

R.33 AS AIRCRAFT CARRIER: Two detail views showing the suspension of the Gloster "Grebes" from the airship's keel. Each machine was suspended by a central quick-release attachment to the top plane centre section, whilst three struts, two to the wings and one to the fuselage near the tail, served to prevent the machine oscillating. Note the flexible piping running from the keel to the side of the fuselage, which conveyed the mixture from the Bristol "Gas" starter (in airship) to the "Grebe's "Jaguar" engine.



["FLIGHT" *Photograph*

"DROPPING THE PILOT"—NEW STYLE : One of the two Gloster "Grebes" carried by R.33 gets well away during the tests at Pulham last Thursday. Piloted by F/O Mackenzie-Richards, the "Grebe" fell about 100 ft. before complete control was obtained, when, opening out his engine—note the "prrrup" of smoke—the pilot made a half-roll and then flew away.

and the other some 160 ft. to the rear—by means of a central quick-release attachment to the top plane centre section, there being struts coming from the airship to points on the port and starboard wings (top) and on the fuselage, near the tail, respectively, to prevent the machine oscillating (not the wireless variety !)

Located in the airship was a Bristol gas starter, which was connected to the "Jaguars" of each "Grebe" by means of flexible piping. Access to each machine from the keel of the airship was made by means of a rope ladder from openings in the keel just above each machine.

Having been successfully manhandled from her shed, R.33 rose gracefully into the air, and was soon cruising overhead at between 2,000—3,000 ft. After circling over the station thus for about an hour and a half, the two pilots, equipped with parachutes, climbed into their respective machines.

Shortly after the "Jaguar" engines were started up; the engine of the rear machine got going properly, but the front engine went on strike and refused to be started. Thus, at 10.17 a.m., Flying Officer Mackenzie-Richards, pilot of the rear "Grebe" pulled his release lever, and the "Grebe" dropped swiftly from the airship. It fell some 100 ft. before its pilot obtained full control and got his engine going all out—this, by the way, is indicated graphically in one of our accompanying illustrations—but as soon as this happened, it gambolled gaily in the air as if glad to be free, at last, from the maternal apron strings. F/O. Mackenzie-Richards eventually made a successful landing.

Apparently, they were still unable to start the engine of the second machine, for soon after the first machine was launched, the R.33 headed for Cardington, with "Grebe" No. 2 still in position, and it was not until 11.40 a.m., when the R.33 arrived over this place, that the engine got going and F/O. Ragg also released himself, and made an equally successful descent. In each case, the speed of the R.33 at the moment of release was about 30 m.p.h., for unlike launching an aeroplane from seacraft, it is essential that the airship's speed should be much less than that of the aeroplane, in order that the latter may quickly fall clear of the airship. On the other hand, it is not essential when launching an aeroplane from an airship for the latter to fly head to wind, whereas the marine aircraft carrier must do so, and, of course, speed is a helpful factor.

Launching the two Grebes, however, was not the only test carried out that day by R.33, for during the flight from Pulham to Cardington, tests were made in connection with the method of calculating the exact altitude of aircraft by means of acoustics. In this method use is made of the speed at which sound travels, which being a known and unvarying factor, enables extremely accurate calculations.

The procedure adopted in this method of altitude measuring is as follows: A detonator is suspended a known distance (in this case, 100 ft.) below the airship, and the charge is exploded by electrical means. A special instrument in the control car records the time that elapses between the explosion and the exact moment at which the echo returns to the airship—or, in other words, the time taken for the sound of the explosion to travel to the ground, or sea, and back again to the airship, and, therefore, the speed of sound being known, the distance the sound had to travel. In Thursday's tests, a study was made of the different character of the echo as affected by varying ground conditions, and we believe some valuable data was obtained.

At the conclusion of the tests, R.33 was berthed in the large shed at Cardington—where R.101 is under construction—but, unfortunately, during the landing operations, some slight damage was caused to the airship by some rather violent "bumps." We understand, however, the damage was not serious, and R.33 was safely housed and the two "Grebes" attached once more into position in readiness for a visit of the Dominions Premiers.

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THE ROYAL AERO CLUB OF THE U.K.

OFFICIAL NOTICES TO MEMBERS

A JOINT Meeting of the Royal Aero Club, Racing Committee, and the Society of British Aircraft Constructors was held at the Royal Aero Club, 3, Clifford Street, W.1. on Wednesday, October 20, 1926, when the following were present :—

Royal Aero Club.—Air Vice-Marshal Sir W. S. Brancker, K.C.B., in the Chair; Lieut.-Col. W. A. Bristow; Lieut.-Col. M. O. Darby; Lord Edward A. Grosvenor; Major R. H. Mayo; Capt. C. B. Wilson, M.C.; Howard T. Wright.

Society of British Aircraft Constructors.—Commander James Bird; H. Burroughes; F. M. Green; John Lord; T. O. M. Sopwith, C.B.E.; H. T. Vane.

In attendance :—H. E. Perrin, Secretary, R.Ae.C.; C. V. Allen, Secretary, S.B.A.C.

The Club submitted proposals for the races for 1927 which included the King's Cup, Aerial Derby and Grosvenor Challenge Cup.

It was decided to further consider these proposals next month

ROYAL AERO CLUB MONTHLY DINNERS

The Royal Aero Club will commence its Winter Monthly Dinners on Wednesday, November 10, next. These dinners are held at the Club and Members wishing to attend are requested to notify the Secretary as early as possible as the accommodation is limited to 60.

The subject for discussion has not yet been definitely settled.

Offices : THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.

H. E. PERRIN, Secretary

LIGHT 'PLANE CLUB DOINGS

London Aeroplane Club.

THE total flying during the week was 57 hours and 50 minutes.

The following members had dual instruction :—Lady Bailey, H. Spooner, S. H. J. Garne, W. L. S. McCleod, J. L. Gardner, C. H. Tutt, V. H. Doree, J. G. Crammond, A. J. Richardson, S. C. Richards, J. J. Hofer, O. J. Marstrand, R. A. St. John, E. A. Lingard, P. W. Hoare, F. C. Elford, H. R. Presland, G. N. Howe, P. G. Lucas, D. P. H. Esler, S. O. Bradshaw, M. P. Susman, H. F. Wright, Miss O'Brian, G. W. Hall, L. Martin.

The following members made solo flights :—P. G. Lucas, E. S. Brough, A. H. M. Lees, A. R. Ogston, W. Hay, Lady Bailey, Miss O'Brian, O. J. Tapper, H. Petre, S. O. Bradshaw, N. J. Hulbert, N. Jones, W. Roche Kelly, Mrs. S. C. Eliott-Lynn, J. J. Barros, E. L. O. Baddeley, H. F. Wright.

On Monday, October 18, 1926, Lady Bailey, Miss O'Brian and J. J. Barros all successfully completed the tests for their Aviator's Certificates.

Joy rides were given to the following members : C. F. Stocks, C. G. Miese, gras, J. Plisich, Miss Marks, J. L. Gardner, P. W. Hoare, R. Malcolm, R. Andrews.

Hampshire Aeroplane Club

REPORT for week ending October 21.—Very high winds and rain have curtailed flying during this week, weather conditions being quite impossible on two days out of the seven. The total flying time for the week was 9 hrs. 20 mins.; instruction flying, 6 hrs. 25 mins.; solo flying, 2 hrs. 30 mins.; Passenger flying, 25 mins.

The following members received instruction :—Messrs. Rumble 1 hr., Bishop 50 mins., Southcliffe 50 mins., Bound 40 mins., Moloney 40 mins., Courtney W., 20 mins.. Stokes 25 mins., Dickson 20 mins., Bailey 15 mins., Kerry 15 mins., Cooper 10 mins., Van den Bergh 10 mins., Perfect 5 mins., and Lieut. Graham, R.N. 25 mins.

Two joy riders braved the elements, viz. :—Mrs. Hoare and Lieut.-Commander Tucker, R.N.

In spite of the adverse weather conditions, Mr. Perfect, who flew his first solo last week, took the air nearly every day and put up a really good show.

Mr. D. Rumble successfully flew his first solo on Tuesday, within a few weeks of taking his first joy-ride.

Other soloists were Messrs. S. Fry, K. P. L. Bowen, Flying-Officer Brodie and last but not least, Capt. F. T. Courtney, the well-known test pilot with Senor De la Cierva of Autogyro fame, as passenger. Capt. Courtney demonstrated that his almost vertical descents on the Autogyro have not impaired his skill in effecting the more usual type of landing.

Yorkshire Aeroplane Club.

REPORT for the week ending October 20 :—Total flying time, 14 hrs. 35 mins. Solo time, 3 hrs. 50 mins. The following members flew solo : Messrs. Fielden, Wood, Norway, and Lax. Instruction, 10 hrs. 45 mins. The following members took dual instruction with Captain West; Messrs. Williams, Wormald, Watson, Ambler, L. Dawson, Harvey, Gratwick, Pigg, Mann, Lister, Captain Beaumont.

On the first three days of this week Captain West was taking a busman's holiday at Brough to do his R.A.F. Reserve training, so that our flying time is rather below the average. However, we have several pupils ready to go solo, and we hope that by the time this report appears Messrs. Mann and Dawson will have been launched.

Early this week G-EBLS was at Brough, where Mr. Fielden managed to fly it with one hand and shoot a wild goose with the other. The goose was seen to go spinning down out of control, but a careful search later failed to reveal the body; under these circumstances it is felt that the goose may be one up on Mr. Fielden.

Mr. Rimmer has been with us on his Avro for the last ten days. After two nights spent in holding the machine down in a field he came to the conclusion that it was time he had some sleep, and so has been flying daily from the aerodrome while carrying out a photographic survey of a part of Leeds for Messrs. Aerofilms.

We have it on the highest authority that two members have bought a pig (less engine) in a poke. The breed has not yet been ascertained, but we are told that it is a two-seater suitable for a six-cylinder in-line engine. We hear that a radial Anzani of pre-war vintage and doubtful power is available for it, and that the trial flights will be carried out by Captain West. No statement has been received from Captain West upon this matter.

At any rate, we are assured that it will not be allowed to join the Wren, whose owner continues to regard it thoughtfully. A brief interview with Squadron-Leader Longton, who described in a few well-chosen words how the machine should be flown to get out of our aerodrome, has not materially assisted the Wren into the air.

The Bluebird is still with us, but by the time these notes appear it will have gone to Croydon to show the Dominion Premiers the sort of aeroplanes we build in Yorkshire. We understand that it is then proceeding to Martlesham for its official trials.

FLIGHT
THE AIRCRAFT ENGINEER & AIRSHIPS

FROM THE FOUR WINDS

Cairo-Karachi Airway

IMPERIAL Airways announce that the first two passenger aeroplanes (D.H. "Hercules," with three Bristol "Jupiter" engines) intended for use on the 2,500-mile airway between Cairo and Karachi will leave England between December 15 and December 20. These machines are the first of a flight of five which are being built specially for the new Empire air route. Air Vice-Marshal Sir W. Sefton Brancker and party will travel on one of the machines to Basra, while the other will proceed only as far as Cairo, accommodation being available for passengers on both machines. The fare from London to Cairo will be £50 and from London to Basra £101. Sir Samuel Hoare, the Secretary for Air, and Lady Maude Hoare and party will leave on a third machine on December 27, and after proceeding along the same route to Basra will continue their flight via the Persian Gulf and Karachi to Delhi. This 6,550 miles flight will constitute the official opening of the new Egypt to India service.

Italy-Brazil Flight

SEN. DE BARROS, the Brazilian pilot who is attempting a seaplane flight from Italy to Santos in Brazil, left Gibraltar on October 25 and arrived that afternoon at Las Palmas (Grand Canary).

Marseilles-Madagascar Flight

LIEUTS. BERNARD and Guibbaud, who left Marseilles in two flying-boats (one Cams-37 G.R., and one Lioré-Olivier) for Madagascar on October 12, arrived at Tangier the same day, and proceeded next morning to Casablanca. They reached Las Palmas (Grand Canary) on October 15.

Australian Pacific Flight

GROUP-CAPT. R. WILLIAMS, Chief of Australian Air Staff, who is carrying out a survey flight of the Pacific Islands in a D.H.50 seaplane (Siddeley "Puma") arrived at Port Moresby on October 11. Rabaul (Bismarck Archipelago) was reached on October 18.

Cross-Channel 'Plane Mishap

TEN passengers in one of the Imperial Airways cross-Channel Handley Page air liners had an exciting adventure on October 21 when, piloted by Capt. F. Dismore, with Mr. Pearson as mechanic, the machine came down in the English Channel while flying from Croydon to Paris. When midway over the Channel the starboard engine failed, and the machine, losing speed, slowly descended towards the water. Meanwhile the pilot sent out the international wireless S O S—"Mayday"—and informed Croydon of what had happened, whilst the mechanic entered the cabin and handed out lifebelts to the passengers, who behaved splendidly with great calmness. A few minutes later Capt. Dismore made an excellent tail-up "landing" on the water, and the passengers—among them were five women—climbed out of the cabin through the emergency opening in the roof. At the time there was not a boat in sight, and gradually the machine began to sink at the nose, the rising water meanwhile forcing the occupants up along the fuselage near the tail. Then two motor fishing smacks were seen rushing to the rescue, having cut their gear adrift to do so. The first to arrive was the *Invicta*, which took off 10 of the occupants, all thoroughly wet but still calm. The second smack came up immediately after and rescued the remaining two. The only loss of life was a Pomeranian dog belonging to one of the women passengers. The mails and some of the valuable cargo were also salved, but the machine sank about half an hour after the passengers were taken off. The skipper of the *Invicta* served tea and other comforts to the rescued, who were taken immediately into Folkestone.

A Turkish Aircraft Factory

THE first Turkish aeroplane factory was opened at Kaisarieh (Anatolia) on October 6. German as well as Turkish capital has been invested in this factory, Herr Junkers, the famous German aircraft constructor, being one of those interested in it.

Budapest-Graz Air Line

A NEW air line, connecting up with the Vienna-Venice line, was opened on October 14 between Budapest and Graz.

An Aerial "Boom"

SPECTATORS on the Philadelphia flying ground were recently astounded to hear a gigantic booming voice making a few remarks from behind a bank of clouds overhead. Then came some music and singing, equally loud and penetrating. A few moments later a twin-engined biplane came into view some 5,000 ft. up, and it was from this machine the "booming" sounds came. The explanation of this new terror is stated to be an amplifying loud speaker apparatus, of enormous power, weighing about half a ton and operated by two men, which has been developed after years of research. With this apparatus, according to the *Daily Chronicle* correspondent, a word spoken in an ordinary tone into a special microphone is so magnified and radiated downward from the aeroplane that it can be made audible without distortion to those below. This "invention" is to be developed in connection with advertising, and an installation is being sent by the "Plane-Speaker Corporation" to Europe!

Another Form of Aerial "Boom"

AN aerial boom of another kind also comes from America for, according to the figures issued by the Daniel Guggenheim Fund for the Promotion of Aeronautics, aeronautics has made extraordinary strides during the last few years. Last year the U.S. aircraft industry turned out products valued at $12,277,000, as against $789,872 in 1914. The establishment of the U.S. air mail service and a growing interest in aviation for other civil uses have been, it is said, factors in this advance, whilst it is stated that the aircraft industry in the U.S. may soon be free of its dependence upon War and Navy Department orders.

Aerial Prospecting in Canada

AN amphibian flying boat in charge of Pilot C. S. Caldwell has returned to High River after spending four months in the Northwest Territories. The 'plane travelled between six and seven thousand miles, and was used to transport a party of three engineers who prospected for minerals. The machine alights and arises with equal ease on land or water, and the trip marks the first use of this type of machine as a mode of transport for prospecting in the Northwest Territories.

Caterpillar Killing from the Air

AT the request of the Forestry Department of Alsace and Lorraine, an aeroplane has been dispatched from Paris to Strasbourg to spray the forests in the neighbourhood of Haguenau with insecticide, with the object of destroying the caterpillars which are eating up the trees. This method has, for some time past, been used successfully on the forests, etc., in America, Canada and Russia.

Guggenheim Propaganda Air Tour

THROUGH the courtesy of Commander Richard E. Byrd, and in co-operation with the Department of Commerce, the Daniel Guggenheim Fund for the Promotion of Aeronautics is sending Byrd's North Pole 'plane on an extensive tour of the United States.

Floyd Bennett, the well-known American pilot, is piloting the 'plane on the tour which will cover the important air routes between the east and west coasts, visiting about forty cities.

The trip is being made primarily as a demonstration of the reliability and safety of commercial flying. Commander Byrd has loaned the 'plane as his contribution toward advancing the cause of aeronautics and to furthering nation-wide interest in air travel and in the use of air mail. It is hoped that as a result of the trip, towns and municipalities along the existing air routes will be encouraged to establish air ports.

Assistant Secretary William P. MacCracken, Jr., of the Department of Commerce, has given every possible aid to the officers of the Guggenheim Fund in arranging the trip. Full co-operation is also being received from the Army and Post Office air services. Through the co-operation of the latter a local pilot thoroughly familiar with local conditions will aid Floyd Bennett in piloting the 'plane between many of the landings.

The flight started from Washington on October 7, making its first stop at New York and its second at Albany. It is reported that in addition to the crew, Assistant Secretaries MacCracken, Davison and Warner, of the Department of Commerce and of the Army and Navy, will accompany the 'plane on its start of the trip from Washington.

Eagle *v.* Aeroplane

ONE of the U.S. air mail 'planes recently collided with a large golden eagle near Elko (Nev.), and as a result, not only was the eagle—which flew head first into the machine—killed, but the impact broke a front wing strut, compelling the pilot to make a forced landing, which was, however, successfully accomplished, but not without much skill on the part of the pilot.

Ibero-American Air Congress

THE first Ibero-American Air Congress opened at Madrid on October 25, all South American States being represented. The Congress will deal with problems of international air legislation from the Spanish, Portuguese, and South American point of view, and will also study the situation of the different air routes for these countries.

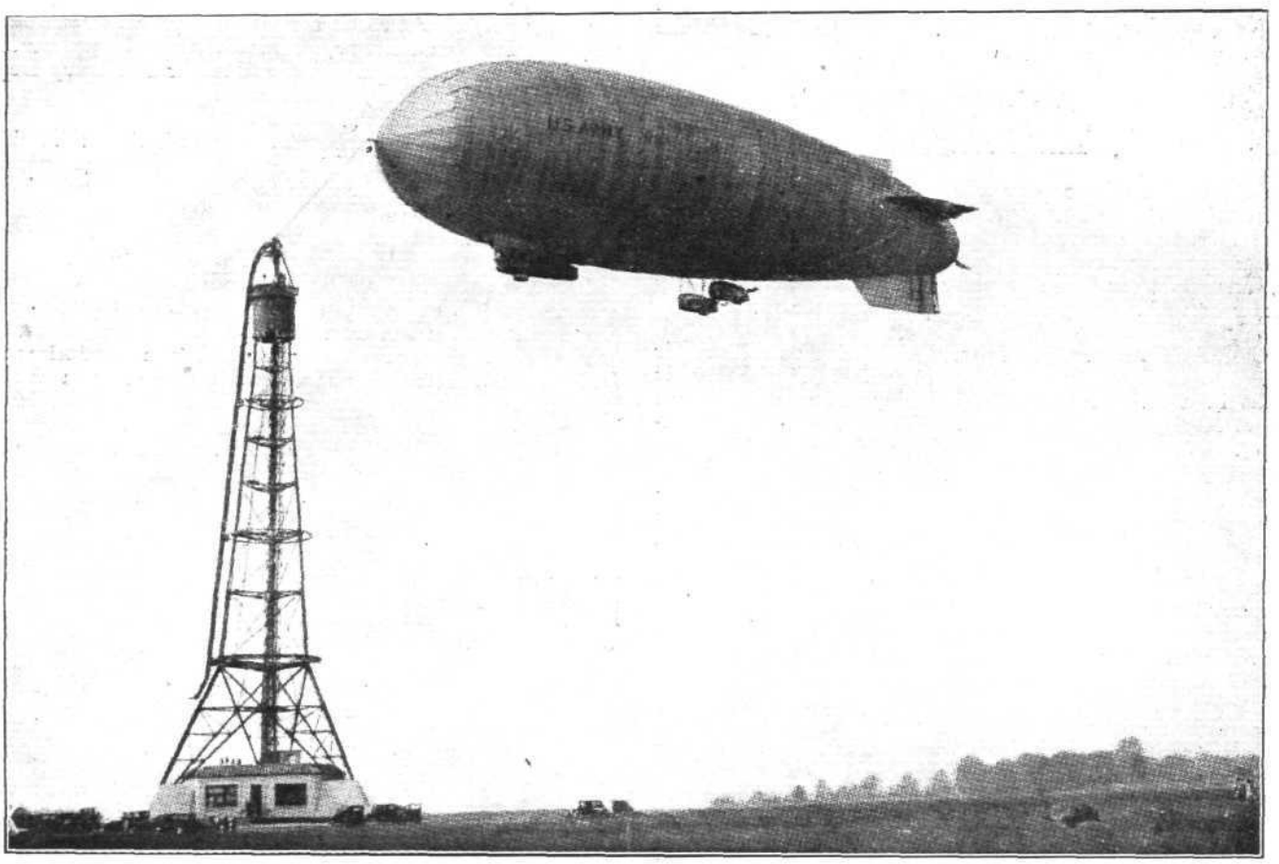
MOORING A SEMI-RIGID AIRSHIP

THERE can be but little doubt that aviation has an enthusiastic and practical supporter in Mr. Henry Ford, for there has been of late increasing activity in aeronautical matters associated with his name. The Ford Airport at Dearborn (Detroit) is now one of the biggest and most active civilian airports in America, and the latest development at this port is the erection of a mooring mast for airships. Furthermore, on September 18 aerial history was made when the first mooring of an airship at a privately-owned mast was successfully accomplished.

On the day in question the big semi-rigid airship RS-1, built by the Goodyear Tyre and Rubber Co. for the U.S. Army, after a night flight, under the command of Col. John Paegelow, of 450 miles from Scott Field, arrived at Detroit early in the morning. Constant wireless communication had been maintained between the Ford station and the airship, and all details of the landing were worked out before the RS-1 arrived. In the absence of an Army representative, who had a forced landing when flying *en route* to the airport, Capt. Herbert V. Theden, Air Corps Reserve and chief designer of the Aircraft Development Corp, took charge of the mooring operation—Fred Lampky, formerly of the Lakehurst Naval Air Station, assisting. Only about 15 other men were actively required in the docking manœuvre, as against about 150 generally required for the usual ground landing.

The Ford Airport and surrounding countryside were completely covered with a blanket of fog, which somewhat hindered progress, but, nevertheless, at 7.5 a.m. Col. Paegelow, after making three circuits of the aerodrome, nosed down, dropped the main mooring cable to the coupling party, and the powerful automatic winch in the tower started pulling the RS-1 down. As the airship neared the tower head its engines were run astern and the small ground party steadied the 'ship's yaw lines. The RS-1 was then made fast, water and petrol lines being immediately coupled to the 'ship's tanks, and the mooring cables withdrawn into the hull.

Henry Ford, who witnessed the entire operations from a vantage point atop of the tower, was the first to greet Col. Paegelow as he climbed out of the forward hatch—this first landing of an airship to his own tower being a proud moment for Mr. Ford, as evidenced by his smiles and remarks. Others present to welcome the RS-1 were W. B. Mayo (Chief Engineer to Henry Ford), Carl B. Fritsche (General Manager, Aircraft Development Corp.), Ralph H. Upson (Chief Engineer to same company and builder of the Ford Tower), and B. Stout (Designer of the Ford-Stout all-metal aeroplanes).



MOORING A SEMI-RIGID AIRSHIP : For the first time in the history of flying a semi-rigid airship—the U.S. Army RS-1—was moored to a privately-owned airship-mooring mast last month. This mast has been erected at the Ford airport, Dearborn, Mich. Henry Ford was at the masthead during the mooring, and was the first to greet the airship's commander, Col. John Paegelow.

The RS-1 rode at the tower all the morning, half the crew remaining on board while the other half stretched their legs below, while a constant stream of visitors climbed in and out of the 'ship, inspecting its interior, etc. Shortly after noon the airship made a preliminary weigh-off, and at 12.15 p.m. finally left the mast in perfect trim.

It was originally planned that the RS-1 should return again to the mast, after a short trip to Selfridge Field, and ride at the mast overnight, but severe storm warnings from Scott Field necessitated a change of programme, and the RS-1 returned to its base. Col. Paegelow and his officers were much impressed with the haul-down device, a feature of the tower which enables the airship to be brought down to and rested on the ground while still secured to the tower. This enables the crew to have ready access from the ground directly, and greatly facilitates servicing and loading the airship.

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The Royal Air Force Memorial Fund

THE usual Meeting of the Grants Sub-Committee of the Fund was held at 7, Iddesleigh House, on October 21. Lieut.-Commander H. E. Perrin was in the Chair, and the other Members of the Committee present were :—Mrs. L. M. K. Pratt-Barlow, O.B.E., Squadron-Leader E. B. Beauman. The Committee considered in all 12 cases, and made grants to the amount of £99 10*s*.

The next meeting was fixed for November 4, at 2.30 p.m.

FLIGHT

THE ROYAL AIR FORCE

London Gazette, October 19,1926.

General Duties Branch

The following Pilot Officers are promoted to rank of Flying Officer :—A. C. Watkins, W. F. Bryanton (August 6) ; W. A. Shorten, K. C. Baker (September 6) ; F. S. O'Hanlon (September 12) ; N. K. Howard (Sept. 17). The following are promoted to rank of Flight Lieutenant (October 13) :—G. E. Wildman-Lushington, Capt. R. M., Flying Officer, R.A.F. ; A. G. Elliot, Lieut., R.N., Flying Officer, R.A.F. The following are placed on half-pay Scale B :—Flight Lieut. A. T. Laing, from October 7 to 30, inclusive : Flying Officer F. W. C. Beaumont (October 21). The following are transferred to Reserve :—

Class A.—Flying Officers :—R. S. Higgins (October 15) ; C. Sutton (October 16).

Class B.—Flight Lieutenant :—A. J. Osborn (October 21).

The following relinquish their temp. commissions on return to Army duty (October 16) :—Flying Officers (Hon. Flight Lieutenants).—E. L. O. Baddeley (Capt., Oxf. and Bucks. L.I.), L. F. Marson, M.C. (4th 7th Dragoon Guards). Flying Officers.—G. V. Carey (Lt., Devon Regt.), P. J. Chalmers (Lt., Border Regt.), C. F. Ellicott (Lt., Dorset Regt.), J. P. Huffman, V.C. (Lt., D. of Wellington's Regt.), G. C. Oldham (Lt., Queen's Royal Regt.). Flying Officer E. A. C. Bushell relinquishes his short service commission on account of ill-health (October 20).

Stores Branch

The following are granted permanent commissions as Pilot Officers on probation with effect from dates indicated and with seniority of Oct. 9 :—J. E. R. Sowman, O. W. T. Rogers, A. A. Quayle, W. A. D. Collingwood, M. S. Shapcott, C. I. Fry, R. B. Horstmann, R. B. Brown, R. S. Sawyer, T. I. Iliff, W. A. Stagg, C. J. Nobbs, H. D. Jackman, E. H. Walker, F. G. Northway, W. G. S. Wood (October 9) ; C. L. Gilbert (October 16). Flight-Lieut. D. Mitchell is placed on the retired list (October 16).

Medical Branch

Flight-Lieut. H. McW. Daniel, M.D., is promoted to rank of Squadron Leader (October 9). Flying Officer A. Harvey, M.B., is promoted to rank of Flight-Lieut. (October 7).

Memorandum

Sec.-Lieut. J. B. S. Forrest relinquishes his hon. commission on enlistment in the Territorial Army (September 29).

Reserve of Air Force Officers

The following are confirmed in rank :—Flying Officer—W. Steele, D.F.C. (October 13). Pilot Officers.—O. M. Shell-Small (October 7) ; L. W. Van Oppen (October 19).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Squadron-Leaders : A. F. A. Hooper, O.B.E., to R.A.F. Base, Gosport, on transfer to Home Estabt., 25.9.26. A. H. Stradling, O.B.E., to H.Q., Egypt, 8.10.26.

Flight-Lieutenants : H. O. Long, D.S.O., to No. 30 Sqdn., Iraq., 1.10.26. R. Harrison, D.F.C., to Aircraft Depot, Iraq, 1.10.26. R. L. Sweeny, to H.Q., Iraq, 30.9.26. F. E. C. Benstead, to No. 4 Armoured Car Co., Iraq., 30.9.26.

Flying Officers : W. A. D. Brook, to H.Q., Iraq, 15.10.26. (Hon. Flight-Lieut.) F. L. Woledge, to H.Q., Iraq, 1.10.26. V. G. H. Gee, to No. 47 Sqdn., Egypt, 7.10.26. G. N. J. Stanley-Turner, to Aden Flight, 1.10.26. A. L. Ottway, to No. 6 Armoured Car Co., Iraq, 1.10.26. C. B. Wincott, to No. 402 Flight, Mediterranean, 15.10.26. O. B. Swain, to Armament and Gunnery Sch., Eastchurch, 18.10.26.

Pilot Officer L. M. S. Knight, to R.A.F. Depot, Uxbridge, on transfer to Home Estbt., 28.9.26.

Stores Branch

Flight Lieutenant F. Whilton, D.C.M., to H.Q., Cranwell, 14.10.26.

Flying Officer A. E. Connolly, to H.Q., Cranwell, on transfer to Home Estabt., 25.10.26.

Pilot Officer C. L. Gilbert, to H.Q., Cranwell, on appointment to a Permanent Commn. (on probation), 16.10.26.

Accountant Branch

Flying Officers : J. J. T. Rose, to R.A.F. Depot, Egypt, 1.10.26. J. Charles, to Heliopolis Details, Egypt, 7.10.26.

SOCIETY OF MODEL AERONAUTICAL ENGINEERS (S.M.A.E.)

As previously reported in the S.M.A.E. notices, the Society sent over three models to America to compete in the Mulvihill Trophy Contest, held at Philadelphia, in September, and reports of this event are now to hand from the U.S.A.

The competition was to be decided solely on the best duration of three flights, the only restriction being that the wing-span should not exceed 40 in. Our machines arrived in America a week before the contest, and during this time were " tuned up " by Mr. Oscar Westgate (an experienced aeromodellist in that country) who also flew the models for us in the actual competition.

The day of the contest (Monday, September 6, 9.30 a.m.), saw 55 models on the Philadelpha Aerodrome, 22 of which competed for the Trophy. The three British entrants representing the S.M.A.E. were : (1) D. A. Pavely ; (2) S. C. Hersom ; (3) T. H. Newell.

The competition proved to be an exceptionally good one as the final results show, the durations from the 5th place downwards being particularly close.

Mr. S. C. Hersom's and Mr. T. H. Newell's models put up durations of 1 min. 31·5 secs. and 1 min. 31·4 secs. respectively. As this was the first occasion on which the S.M.A.E. has participated in an international flying competition, the obtaining of 4th place is very encouraging.

Mulvihill Trophy, 1926—*held at Philadelphia, U.S.A.*

Position.	Name.	Club represented	Duration of flight.	Prize.
			min. secs.	
1	J. Loughner	Michigan Model Airplane Club	2 31·4	Mulvihill Trophy and 200 dollars
2	J. Lucas ..	Illinois Model Aero Club	2 9·4	100 dollars
3	B. Pond ..	Illinois Model Aero Club	1 57·4	75 dollars
4	D. A. Pavely	Society of Model Aeronautical Engineers	1 38·2	50 dollars
5	A. O. Heinrich	—	1 34	30 dollars

This year's flying programme having now come to an end, the Society's indoor meetings will be held at Headquarters (Central Y.M.C.A., Tottenham Court Road, W.C.1), on Friday evenings, at 7.30, on the following dates :—November 5, November 19, December 3, and December 17.

B. K. JOHNSON, *Hon. Secretary.*

Sir Samuel Hoare

THE Secretary of State for Air, Sir Samuel Hoare, addressed a meeting of the City of London Debating Club on October 14, his subject being " Some Aspects of Imperial Defence," in which he made some important references to the Air Service, airships, etc.

Sir Samuel Hoare will be the guest of the evening at a political house dinner to be held at the Ladies' Carlton Club on Friday, November 5. Lady Newton will preside.

The Citizen Air Force in Training

THE two London squadrons, No. 600 (City of London) Bombing Squadron, and No. 601 (the County of London) Bombing Squadron, recently completed their first annual training, at Manston Aerodrome, Kent, and Lympne Aerodrome, near Hythe, as did the two northern squadrons No. 602 (Glasgow) and No. 603 (Edinburgh), stationed at Leuchars Air Station, seven miles south-east of Dundee. Practically all the *personnel* available attended, in many cases for the full 15 days' training The total of 27 officers and 194 airmen of the Auxiliary Air Force underwent training on an aerodrome this year. The force was only instituted a year ago. Another squadron, No. 605 (City of Birmingham), is now being formed, with its aerodrome at Castle Bromwich. Squadron-Leader Cecil Wright, who served with the Royal Air Force in the war, and has now taken refresher courses, has been appointed officer commanding.

Royal Air Force Flying Accident

THE Air Ministry regrets to announce that as the result of an accident at Moascar, Ismailia, Egypt, to a Bristol Fighter of No. 208 Squadron, Moascar, on October 18, Flying Officer Vincent Bingham Bingham-Hall, M.C., the pilot of the aircraft and P.O. 15,909 Marine William Higgins, Royal Marines, were killed

AIR POST STAMPS

By DOUGLAS B. ARMSTRONG

(Editor of "The Stamp Collector")

Inland Air Post in Uruguay

A FOURTH stamp was added to the latest air mail series of Uruguay in the so-called "Seagull" design, on March 17, in the form of a 25 centisimos denomination, printed in purple. It was used exclusively in connection with a series of experimental flights which were carried out between Montevideo and Rocha and *vice versa*, with the object of ascertaining the possibilities of a regular air post service to the interior, on March 17, 19, 22, 24, 26 and 28.

Early Date Egyptian Covers

IN a recent instalment of these jottings we gave the date of issue of the new Egyptian air post stamps as March 10, which is that generally accepted. Mr. J. Franklin informs us, however, that he has a cover in his collection that was carried from Cairo to Baghdad by air on March 9, and was prepaid by the 27 milliemes stamp. It seems that about 100 letters were flown on the earlier date, and they should be well worth hunting for in view of the growing importance that is rightly attached to "first flight" covers by air post specialists.

U.S.A. Contract Air Mails

SOME highly interesting air post covers have resulted from the inauguration of contract air mail services over various intermediate routes under authority of the United States Post Office Department.

The first of these services was put in operation between Detroit, Chicago and Cleveland by the Ford Motor Co. on February 15, 1926, when a special cachet was applied to air-borne correspondence consisting of a large double-lined circle with the town name and date in the centre, and inscription "FIRST FLIGHT INAUGURATING CONTRACT AIR MAIL SERVICE in U.S.—CHICAGO—DETROIT—CLEVELAND."

Cachets of a similar type were employed on the institution of contract air mail lines connecting Jacksonville-Tampa-Fort Myers-Miami (on April 1); Elko-Boise-Idaho-Pasco (on April 6); Salt Lake City-Las Vegas-Los Angeles (April 17); and Chicago-Moline-St. Joseph-Kansas City-Oklahoma City-Fort Worth-Dallas (May 12).

The home-town of Abraham Lincoln, Springfield, Illinois, indulged in a more ambitious form of cachet supplemented by a souvenir postmark which includes a medallion portrait of Lincoln followed by the words "FIRST FLIGHT—CONTRACT AIR MAIL—Chicago-St. Louis Route. Inaugurated April 15." A certificate was published by the Postmaster of Springfield that this special cancellation would never again be used, and the public was urged to "mail some letters on the first flight."

Three other contract routes authorised under the scheme have yet to be opened up to regular service, viz., Boston to New York *via* Hartford (Conn.); Seattle (Wash.) to Los Angeles (Cal.) *via* Portland, Medford, Sacramento, San Francisco, Fresno and Bakersfield; and Chicago to Minniapolis *via* Milwaukee, La Crosse and St. Paul. Particulars of the cachets used in these instances will appear in this column in due course.

Chilian Air Stamps in Sight

FROM time to time there have been rumours of the impending establishment of an official air post service connecting the principal towns of Chile. The latest report is to the effect that a special series of air post stamps is in preparation for issue when the projected air mail line is opened.

Latest Swiss Flights

THE opening of a new air post line from Chaux-de-Fonds to Basle on May 15, 1926, was attended by the issue of souvenir cards and envelopes designs by the eminent Swiss artist L'Eplatternier, and inscribed "I ere Poste Aerienne La Chaux de Fonds (La Locle), Bale." The cards were sold for 10 centimes each, and the envelopes (for printed matter) for 5c. in addition to the regular postage. Flown covers bore in addition the impression in violet of a rectangular cachet containing the winged wheel emblem of the Societe Navigation Horlogere Aerienne Nhora, under whose auspices the service is maintained.

A SPECIAL air post flight was authorised by the Swiss Ministry of Posts and Telegraphs in connection with the tenth annual Trade Fair held at Basle on May 28, when private air postcards and vignettes were provided by the Fair organisers. A particular postmark was also granted with the following inscription, "Flugpost Basel Luzern, 28 Mai 1926, 10 Jahriges Jubilaum der Schweizer Mustermesse in Basel."

PUBLICATIONS RECEIVED

Northampton Polytechnic Institute Announcements, Educational and Social, for the Session, 1926-1927. The Northampton Polytechnic Institute, 280, St. John Street, London, E.C. 1.

Aluminium Foundrywork. The British Aluminium Co., Ltd., Adelaide House, King William Street, London, E.C. 4.

The Book of the Aeroplane. By Capt. J. Laurence Pritchard. Longmans, Green and Co., 39, Paternoster Row, London, E.C. 4. Price 7*s*. 6*d*. net.

Aeronautical Research Committee Reports and Memoranda: *No.* 1029 (E. 20).—Hydrogen as an Auxiliary Fuel for a Solid Injection Oil Engine By G. F. Mucklow. April, 1926. Price 1*s*. net. *No.* 1032 (*Ae.* 224).—Wind Tunnel Tests on a Wing Covered with Monel Metal Gauze. By F. B. Bradfield. February, 1926. Price 4*d*. net. H.M. Stationery Office, Kingsway, London, W.C.2.

Rolls-Royce Bulletin. *October*, 1926. Rolls Royce, Ltd., 14, Conduit Street, London, W.1.

The Accessory. *October*, 1926. *Vol.* 12. *No.* 130. Brown Brothers, Ltd., Great Eastern Street, London, E.C.2.

The Effect of Reduced Intake—Air Pressure and of Hydrogen on the Performance of a Solid-Injection Oil Engine. By G. F. Mucklow, M.Sc. The Institution of Automobile Engineers, Watergate House, Adelphi, London, W.C.2.

Monthly Journal of the British Empire Chamber of Commerce in the United States of America. *August*, 1926. *Vol.* 6. *No.* 9. The British Empire Chamber of Commerce in the United States of America. 25, Broadway, New York, U.S.A.

Book of Laws and Regulations of Civil Aviation. The Aviation Publishing Offices, Moscow.

Catalogues

The "Jubilee" Worm Drive Clips. L. Robinson and Co., London Chambers, Gillingham, Kent.

AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motor. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

APPLIED FOR IN 1925

Published October 28, 1926.

14,561. J. B. STRAUSS. Flying machines. (258,917.)
14,562. J. B. STRAUSS. Dirigible flying machines. (258,918.)
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